PILOT'S OPERATING HANDBOOK

DUPLICATE

PIPER AZTEC F

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3 AND FAR PART 21, SUBPART J. THIS DOCUMENT INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND FAR PART 21, SUBPART J AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

AIRPLANE SERIAL NO. 27-7954048

AIRPLANE REGISTRATION NO. N362BP

PA-23-250 (SIX PLACE)
REPORT: 1948

FAA APPROVED BY: Paul E Everly
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PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA

HANDBOOK ISSUE DATE: OCTOBER 1, 1975
AIRPLANE APPROVAL DATE: JANUARY 20, 1975

HANDBOOK PART NO. 761 594

PIPER

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WARNING

EXTREME CARE MUST BE EXERCISED TO LIMIT THE USE OF THIS MANUAL TO APPLICABLE AIRCRAFT. THIS MANUAL REVISED AS INDICATED BELOW OR SUBSEQUENTLY REVISED IS VALID FOR USE WITH THE AIRPLANE IDENTIFIED ON THE FACE OF THE TITLE PAGE WHEN OFFICIALLY APPROVED. SUBSEQUENT REVISIONS SUPPLIED BY PIPER AIRCRAFT CORPORATION MUST BE PROPERLY INSERTED.

MODEL PA-23-250 (SIX PLACE), AZTEC F

PILOT'S OPERATING HANDBOOK, REPORT: 1948 REVISION 14

PIPER AIRCRAFT CORPORATION
APPROVAL SIGNATURE AND STAMP

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APPLICABILITY

Application of this handbook is limited to the specific Piper PA-23-250 (Six Place) model airplane designated by serial number and registration number on the face of the title page of this handbook.

This handbook cannot be used for operational purposes unless kept in a current status.

REVISIONS

The information compiled in the Pilot's Operating Handbook will be kept current by revisions distributed to the airplane owners.

Revision material will consist of information necessary to update the text of the present handbook and/or to add information to cover added airplane equipment.

I. Revisions

Revisions will be distributed whenever necessary as complete page replacements or additions and shall be inserted into the handbook in accordance with the instructions given below:

1. Revision pages will replace only pages with the same page number.
2. Insert all additional pages in proper numerical order within each section.
3. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the outside margin of the page, opposite revised, added or deleted material. A line along the outside margin of the page opposite the page number will indicate that an entire page was added.

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified by symbols.

ORIGINAL PAGES ISSUED

The original pages issued for this handbook prior to revison are given below:

Title, ii through v, 1-1 through 1-14, 2-1 through 2-10, 3-1 through 3-16, 4-1 through 4-18, 5-1 through 5-60, 6-1 through 6-62, 7-1 through 7-40, 8-1 through 8-14, 9-1 through 9-34, and 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-23-250 (Six Place) Aztec F Pilot's Operating Handbook, REPORT: 1948 issued October 1, 1975.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 - 761 594 (PR751015)	6-29	Revised Item and Weight of 57b.	
	6-37	Revised Item of 167.	
	6-41	Added Item 203.	
	6-43	Revised PAC Dwg. No. of 221.	
	9-i	Revised heading; added No. 7.	
	9-31	Revised Section 2 - Limitations, Items (b), (d), and (e).	
	9-35, 9-36	Added pages (Supplement 7, AutoControl IIIB).	
	9-37		
	9-38	Added intentionally left blank page.	Paul E. Everly Oct. 15, 1975 P E Everly
Rev. 2 - 761 594 (PR760126)	2-3	Added Item (d) to Paragraph 2.11.	
	2-5	Revised Item (c) and added Item (d), Para. 2.19.	
	2-7	Revised Item (c) (1); revised NOTE.	
	3-i	Revised page no. of Para. No. 3.57.	
	3-9	Revised Para. 3.7 (Loss of Power).	
	3-10	Revised Para. 3.9 (Unfeathering Procedure).	
	3-11	Revised Para. 3.21 (Rough Air Operation).	
	3-12	Revised NOTE in Para. 3.23 (Extending Gear with CO_2).	
	3-14	Revised Para. 3.45 (Door Open In Flight); revised Para. 3.47 (Spin Recovery).	
	3-15	Revised Para. 3.51 (Gear Up Landing); revised Para. 3.53 (Engine Failure During Takeoff); relocated Para 3.57 to page 3-16.	
	3-16	Added Para. 3.57 relocated from previous page.	
	4-6	Added item to Before Starting Engines procedures; revised last item in Starting Engines procedures.	
	4-9	Revised Para. 4.9 (Preflight Check).	
	4-10	Revised Preflight Check information.	
	4-11	Changed Starting Engines procedures; revised Para. 4.15 (Pre-Taxi and During Taxi).	
	4-12	Revised magneto check in Para. 4.17 (Engine Run-Up); revised Para. 4.19 (Before Takeoff).	
	4-13	Revised Para. 4.21 (Takeoff); revised Para. 4.23 (Climb); revised Para. 4.25 (Cruise).	
	5-3	Revised Wind Direction in Para. 5.5, Item (a) (3).	
	5-6	Revised Wind Direction in Item (i).	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 - 761 594 (PR760126) (cont)	5-14	Revised Example for Wind Components graph.	
	5-34, 5-35, 5-36, 5-37, 5-42, 5-43, 5-44, 5-45	Added "Knots" label to Cruise Performance Tables.	
	5-56	Revised Example for Time, Distance, and Fuel to Descend Graph.	
	6-1	Revised Para. 6.1 (General).	
	6-4	Deleted stations from Fig. 6-3 (Leveling Diagram).	
	6-5	Revised formula in Item (2).	
	6-12	Added Item (f) to Para. 6.9.	
	6-13	Revised Fig. 6-11 (Sample Loading Problem); deleted Outboard Fuel Table.	
	6-14	Revised Fig. 6-13 (Work Sheet); deleted Outboard Fuel Table.	
	6-20	Added NOTE to Para. 6.13 (Instruction For Using Plotter).	
	6-35	Deleted Item 145.	
	6-37	Added Item 175.	
	6-47	Revised Item 281.	
	6-49	Revised Items 313 and 323.	
	6-51	Revised Item 363.	
	6-52	Revised Items 379, 391, and 393; added Item 392.	
	6-53	Revised Items 413, 415, and 431.	
	6-54	Deleted Item 441; revised Items 443, 447, and 449.	
	6-55	Revised Items 457 and 459.	
	6-56	Revised Items 479, 491, and 501; added Items 484 and 485.	
	6-57	Deleted Item 511; revised Items 521 and 525.	
	6-58	Revised Items 537 and 557.	
	7-1	Revised Para. 7.3 (Airframe).	
	7-5	Revised Para. 7.13 (Fuel Injection).	
	7-7	Revised Para. 7.15 (Engine Controls).	
	7-23	Revised Para. 7.31 (Pitot-Static System).	
	7-30	Revised callouts nos. 1 and 7 on Fig. 7-29.	
	7-33	Added information to Para. 7.47 (Oxygen System).	
	8-10	Revised Para. 8.23 (Oil Requirements); revised Item (c) of Para. 8.25 (Fuel System).	
	9-7	Revised Item (h).	Paul E. Everly Jan. 26, 1976
	10-2	Revised Safety Tip (o); added Safety Tip (r).	P E Everly

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 - 761 594 (PR760917)	1-3	Revised item 1.7 (c) (Fuel Grade).	
	1-4	Revised item 1.9 (c) (Oil Viscosity) and 1.13 (a) and (b).	
	1-6, 1-7	Revised item 1.19 (c) (Power Terminology).	
	2-i	Revised idex per text.	
	2-2	Added Best S.E. Angle of Climb Speed to item 2.3.	
	2-7	Revised item 2.19 (c) Note.	
	2-8	Added items 2.21, 2.23 and 2.25 from page 2-9; added new item 2.27 (Crew Limits).	
	2-9	Relocated items 2.21, 2.23 and 2.25 to page 2-8; revised Placard's item no. (2.27 to 2.29); added placards from page 2-10.	
	2-10	Relocated placards to page 2-9.	
	3-i	Revised index per text.	
	3-3 thru 3-16	Emergency Procedures revised completely.	
	3-17, 3-18	Added pages.	
	4-2	Added Best Angle of Climb Speed.	
	4-13	Revised item 4.21 (Takeoff).	
	5-5	Revised item 5.5 (f) (Cruise).	
	5-13	Revised Stall Speeds Graph (New Curve).	
	5-21	Revised Multi-Engine Climb Performance Graph (Climb Speed).	
	5-22, 5-24	Revised Example and mixture condition.	
	5-26	Revised mixture condition.	
	5-28	Revised mixture condition.	
	5-39, 5-40	Revised mixture condition in NOTE.	
	5-41	Added item 4.	
	5-49, 5-50	Revised mixture condition in NOTE.	
	5-51	Revised Figure Title (added Turbo).	
	5-56	Revised Example.	
	5-59, 5-60	Added Engine Designation.	
	6-17	Revised Forward C.G. Limits (95 to 99).	
	6-33	Revised items 105 and 107.	
	6-37	Revised items 167 and 169.	
	6-43	Added item 216 (ELT).	
	6-45	Revised items 251 and 253.	
	6-47	Added items 294 (Glide Slope Coupler), 297 (FCS-810 AFCS w/o F/D) and 299 (FCS-810 AFCS with F/D).	
	6-49	Revised items 311, 313, 315, 317, 319 and 321; relocated item 323 to page 6-50.	
	6-50	Added and revised item 323 from page 6-49; added item 324 (CTM-1-23).	
	6-52	Revised item 399.	
	6-53	Revised items 413, 415, 417, 421, 423, 425, 427, 429, 431; added item 433 (CLC-60).	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 - 761 594 (PR760917) (cont)	6-55	Revised item 455; added items 461, 463, 464 and 465 (Encoding Altimeters).	
	6-56	Added item 481 (KI-226); revised items 483 and 484; added item 487 (ADF/RMI).	
	6-61	Revised item 603.	
	7-9	Revised Para. 7.17 (Landing Gear).	
	7-15	Added Nomenclature to illustration (Fuel Controls).	
	7-20	Revised Para. 7.29 (Gyro Vacuum System).	
	7-33	Revised Para. 7.47 (Oxygen System).	
	7-34	Added Figure 7-32 (Oxygen Duration Chart).	
	7-35	Revised Para. 7.51 (Cabin Features).	
	7-36	Added nomenclature to illustration (Cabin Door Latches).	
	7-38, 7-39	Revised Para. 7.61 (ELT).	
	8-5	Revised item 8.9 (c) (2).	
	8-6	Revised item 8.9 (d) (4).	
	8-10	Revised Para. 8.23 (Oil Recom. Table); revised item 8.25 (a); relocated item 8.25 (c) to page 8-11.	
	8-11	Added item 8.25 (c) from page 8-10; revised item 8.25 (d).	
	9-i	Added Supplements 8 and 9.	
	9-3	Revised Section 1 - General.	
	9-4	Added item (f), Section 4.	
	9-5	Revised Section 1 and Section 2 item a. - Note.	
	9-6	Revised EGT Green Arc.	
	9-7	Added Best Single Engine Angle of Climb Speed tc item (f), Section 2.	
	9-11, 9-17, 9-23, 9-31, 9-35	Revised Section 1 - General.	
	9-39 thru 9-46	Added pages (FCS-810 AFCS Without Flight Director).	
	9-47 thru 9-52	Added pages (FCS-810 AFCS With Flight Director).	
	10-1	Revised items (h) and (k).	
			Paul E. Everly Sept. 17, 1976 PE Everly
Rev. 4 - 761 594 (PR761119)	4-17	Deleted item 4.39 (c) (3) - Crossfeed Operation During Single Engine Operation. 1	Paul E. Everly Nov. 19, 1976 PE Everly

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 594 (PR770411)	1-6	Added Vsse to para. 1.19; relocated material to page 1-7.	
	1-7	Added relocated material from page 1-6; relocated material to page 1-8.	
	1-8	Added relocated material from page 1-7.	
	2-2	Revised calibrated Vxse in para. 2.3.	
	2-9	Revised forward baggage compartment placard; relocated material to page 2-10.	
	2-10	Revised rear baggage compartment placard; added relocated material from page 2-9.	
	3-3	Revised Speeds in para. 3.3, added Vsse.	
	3-5	Revised Air Start procedure in para. 3.3.	
	3-12	Revised Air Start procedure in para. 3.7.	
	4-2	Added item (k), Vsse, to para. 4.3.	
	4-12	Added info to para. 4.19.	
	5-5	Revised flight planning example.	
	5-9	Added Figures 5-2 and 5-4.	
	5-11	Relocated example in Fig. 5-1.	
	5-11a	Added Fig. 5-2, Airspeed Calibration - Alternate Source.	
	5-11b	Relocated Fig. 5-3 from page 5-12.	
	5-12	Added Fig. 5-4, Altimeter Correction - Alternate Source.	
	6-16	Revised Moment.	
	6-34	Added item 117, OAT gauge.	
	6-49	Added Dwg. 15903-2 to item 321.	
	6-53	Revised item 429 to 428; added items 429 & 430, KN-74 per Dwg. 15976-7, -8 respectively; relocated item 433 to page 6-54.	
	6-54	Added item 433 from page 6-53.	
	6-55	Added item 469, RDR-150 per PAC Dwg. 28297-2.	
	6-61	Revised Moment for item 615.	
	7-2	Added info to para. 7.7.	
	7-12	Revised info in para. 7.21.	
	7-23	Added info to para. 7.31.	
	8-6	Revised item (d) (6) in para. 8.9.	
	8-13	Added info to items (c) (6) and (d) (5) in para. 8.29.	
	8-14	Revised para. 8.29 (h) info.	
	9-3	Revised placard in Section 2 - Limitations.	
	9-6	Revised EGT lower arc limit in item (e).	
	9-7	Revised calibrated Vxse in item (f).	
	9-39	Added item (g) to Section 2.	
	9-42	Added info to Section 4 (d).	
	9-47	Added item (g) to Section 2.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 594 (PR770411) (cont)	9-50	Added info to Section 4 (d).	R.L. Taylor April 11, 1977 R L Taylor
	10-3	Added tip (s).	
Rev. 6 - 761 594 (PR770826)	1-11, 1-12, 1-13, 1-14	Revised para. 1.21, Conversion Factors.	
	5-52	Added key to Figure 5-79.	
	6-35	Added item 145.	
	6-48	Added items 301, 303 and 305.	
	9-i	Added AltiMatic X Supplement.	
	9-53 thru 9-64	Added pages (added Supplement 10, Altimatic X)	Paul E. Everly August 26, 1977 P E Everly
Rev. 7 - 761 594 (PR771202)	1-4	Revised footnote.	
	3-i	Revised pg. no.	
	3-3	Revised Note under Engine Securing Procedures; revised Engine Failure During Takeoff procedure.	
	3-4	Revised Note under Single Engine Landing; added footnote.	
	3-5	Revised Single Engine Go-Around procedure; added footnote; relocated Emergency Gear Extension to pg. 3-6.	
	3-6	Added info. form page 3-5; relocated Going Into Crossfeed to pg. 3-7.	
	3-7	Added Going Into Crossfeed from pg. 3-6.	
	3-9	Revised and added Note to Engine Securing Procedure; relocated Engine Failure During Takeoff (between 64 KIAS and 83 KIAS) to pg. 3-10.	
	3-10	Added info. from pg. 3-9; relocated info. from Engine Failure During Flight (Below 64 KIAS) to pg. 3-11.	
	3-11	Added info. from pg. 3-10; revised Single Engine Landing info.	
	3-12	Revised Single Engine Go-Around Procedure; added footnote.	
	3-14	Revised Extending Gear With CO_2 procedure.	
	4-i	Revised pg. no.	
	4-6	Added info. to Before Starting Engines and Starting Engines; relocated Pre-Taxi and during Taxi to pg. 4-7.	
	4-7	Added info. from pg. 4-6.	
	4-8	Added info. to Shut Down.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 7 - 761 594 (PR771202) (cont)	4-9	Revised para. 4.9, Preflight Check info.	
	4-10	Added info. to para. 4.11, Before Starting Engines; relocated para. 4.13, Starting Engines to pg. 4-11.	
	4-11	Added info. from pg. 4-10; added info. to para. 4-13, Starting Engines and 4.15, Pre-Taxi and During Taxi; relocated info to pg. 4-12.	
	4-12	Added info. from pg. 4-11; relocated info to pg. 4-13.	
	4-13	Added info. from pg. 4-12; relocated info. to pg. 4-14.	
	4-14	Added info. from pg. 4-13; relocated info. to pg. 4-15.	
	4-15	Added info. from pg. 4-14; revised para. 4.31, Go-Around.	
	4-16	Added info. to para. 4.35, Shut Down.	
	5-39. 5-40	Revised Turbo Cruise Curves.	
	6-27	Added item 35.	
	7-i	Revised page no.	
	7-10	Revised para. 7.21, Hydraulic System.	
	7-11	Added serial no. effectivity and (Single Hydraulic Pump) to Figure 7-11.	
	7-12	Relocated para. 7.21 info. and para. 7.23 to pg. 7-12a; added Figure 7-8.	
	7-12a, 7-12b	Added page (added info. from pg. 7-12).	
	7-38	Revised para. 7.61, Emergency Locator Trans.	
	9-53	Revised Section 2, item (d).	
	9-56	Revised illustration and item (b) under para. 4.2, Cockpit Control and Functions.	
	9-57	Revised item 4.2 (k).	Paul E. Everly
	9-61	Revised para. (d) (3).	December 2, 1977 P E Everly
Rev. 8 - 761 594 (PR780601)	iv-f	Added page 9-61 to Rev. 7 log.	
	1-5	Revised V_{MC} definition. Relocated info. to pg. 1-6.	
	1-6	Added relocated info. from pg. 1-5; revised V_{SSE} definition.	
	2-1	Revised V_{MC} to V_{MCA}.	
	3-3	Revised para. 3.3 speeds; added kit no. to ser. no. effectivity.	
	3-4	Added kit no. to ser. no. effectivity.	
	3-5	Revised Single Engine Go-Around; added kit no. to footnote.	
	3-9	Added kit no. to NOTE.	
	3-11	Added kit no. to ser. no. effectivity.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 8 - 761 594 (PR780601) (cont)	3-12	Added kit no. to ser. no. effectivity.	
	3-14	Added kit no. to ser. no. effectivity.	
	4-i	Added para. 4.41 and 4.43.	
	4-2	Revised para. 4.3 (f) and (k)	
	4-10	Revised para. 4.11.	
	4-16	Revised para. 4.35.	
	4-18	Added para. 4.41 and 4.43.	
	4-19	Added new page.	
	6-1	Revised para. 6.1.	
	6-27	Added footnote.	
	6-39	Added item 193.	
	6-53	Added new item 419; relocated item 431 to pg. 6-54.	
	6-54	Added item 431 from 6-53; added new item 435.	
	7-10	Revised para. 7.21.	
	7-11	Revised Fig. 7-7.	
	7-12	Revised Fig. 7-8.	
	7-24	Revised Fig. 7-23.	
	7-26	Added info. to para. 7.35.	
	9-23, 9-24 9-25, 9-26 9-27, 9-28 9-29	Completely revised Supplement 5.	Paul E. Everly June 1, 1978
			P E Everly
Rev. 9 -761549 (PR780904)	1-6	Corrected spelling.	
	1-12	Revised ft-lb and kg conversions.	
	1-13	Revised spelling.	
	5-25,5-26	Revised Associated Conditions	
	6-47	Revised item 294.	
	6-48	Revised items 301, 303 and 305; added items 307 and 309.	
	6-49	Revised items 311, 313, 315, 317 and 319; revised and relocated item 321 to pg. 6-50; revised item no.	
	6-50	Added items 327 and 329.	
	6-50a	Added pg. (added item 331)	
	6-50b	Added pg.	
	6-51	Added item 364.	
	6-52	Revised item nos.; added items 394 and 395; relocated items 399 and 401 to pg. 6-53.	
	6-53	Added items 396, 397 and 398; added items 399 and 401 from pg. 6-52; revised item nos; relocated items to pg. 6-54.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 9 - 761 549 (PR780904) (cont)	6-54	Added items 417, 418, 419 and 420; added items from pg. 6-53; relocated items to pg. 6-55; added items 430 and 431.	
	6-55	Added items 432 and 433; added items from pg. 6-54; relocated items to pgs. 6-56 and 6-57	
	6-56	Added items from pg. 6-54; added items 461, 462, 466 and 467; relocated items to pgs. 6-57, 6-58 and 6-59.	
	6-57	Added items from pgs. 6-55 and 6-56; relocated items to pg. 6-59.	
	6-58	Added items from pg.6-56; relocated items to pg. 6-60.	
	6-59	Added items from pgs. 6-56 and 6-57.	
	6-60	Added items from pg. 6-58; added items 559 and 561.	
	7-38,7-39	Revised ELT info.	
	7-40	Added ELT info.	
	9-i	Added Supplement 11,KFC 200 AFCS (without Flight Director) and Supplement 12, KFC 200 AFCS (with Flight Director).	
	9-65 thru 9-72	Added Supplement 11,KFC 200 AFCS (without Flight Director)	P E Everly
	9-73 thru 9-82	Added Supplement 12, KFC 200 AFCS (with Flight Director).	~~Paul~~ E. Everly Sept. 4, 1978
Rev. 10 - 761 549 (PR781012)	6-43	Added item 214.	P E Everly Paul E. Everly Oct. 12, 1978
Rev. 11 - 761 594 (PR790810)	1-2	Added serial numbers Fig. 1-1.	
	1-2a	New three view Fig. 1-1a.	
	1-2b	New page.	
	1-4	Revised para. 1.13	
	2-i	Added para. 2.28.	
	2-8	Added para. 2.28.	
	2-9	Added serial numbers.	
	2-10	Revised warning.	
	3-3	Added foot note.	
	3-6	Added serial numbers.	
	3-11	Added foot note.	
	3-14	Revised para. Extending Gear with CO^2.	
	6-1	Revised para. 6.1.	
	6-27	Revised items 17,21,27,33. Added foot note.	
	6-31	Revised item 73; added item 83.	
	6-35	Added foot note.	
	6-37	Added foot note.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 11 - 761 594 (PR790810) (cont)	6-43	Revised item 223.	
	6-45	Added item 252.	
	6-49	Changed item 311 to 310. Added item 311, Moved items 317 and 319 to pg. 6-50.	
	6-50	Added item 316. Relocated 317 and 319 from pg. 6-49. Moved items 327 and 329 to pg. 6-50a.	
	6-50a	Revised item 327. Relocated items 327 and 329 From pg. 6-50.	
	6-52	Added items 385 and 387.	
	6-53	Changed 409 to 407. Added items 403, 405, and 407. Moved items 414, 415 and 416 to pg. 6-54.	
	6-54	Changed item 421 to 420. Added item 421. Relocated items 414, 415 and 416 from pg. 6-53. Moved items 228, 229, 230 and 231 to pg. 6-55.	
	6-55	Relocated items 228, 229, 230 and 231 from pg. 6-54. Moved items 444 and 449 to pg. 6-56.	
	6-56	Relocated items 444 and 449 From pg. 6-55. Changed item 457 to 458; 458 to 459; 459 to 460; 460 to 461; 461 to 462; and 462 to 463. Added items 454 and 457. Revised item 455 and 463. Moved item 467 to pg. 6-57.	
	6-57	Relocated item 467 from pg. 6-56. Relocated items 482 and 483 from pg. 6-58.	
	6-58	Changed item 487 to 486 and 489 to 490. Revised items 482, 483 and 488. Added items 487 and 489.	
	7-13	Revised para. 7-25.	
	7-14	Revised Fig. 7-9.	
	7-20	Revised Warning.	
	8-2	Revised para. 8.3	
	9-8	Changed para. j to k. Added para. j. Moved Section 4 to pg. 9-9.	
	9-9	Relocated Section 4 from pg. 9-8.	
	9-65	Revised Section 1 and Abbreviations.	
	9-66	Revised Section 2 and Section 3.	
	9-67	Revised para. c,d,and e. Moved caution to pg. 9-68.	
	9-68	Relocated caution from pg.9-67. Change para c to d; d to e, and e to f. added para. c. Revised para. b, and d. Change para. f to g and g to h Moved para e, f and g to pg. 9-69.	
	9-69	Relocated para. e,f and g from pg. 9-68. Moved part of para. h to pg. 9-70.	
	9-70	Relocated Part of para. h from pg. 9-69. Change para. h to i. Move part of para. i to pg. 9-71	
	9-71	Relocated para.i. Revised Note. Revised sub-para. (4). Moved sub-para. (7), (8) and (9) to pg. 9-72.	

PILOTS OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 11 - 761 594 (PR790810) (cont)	9-72	Relocated sub-para (7), (8) and (9) from pg. 9-71. Changed para. i to j,j to k, and k to l. Revised para. k and l. Added caution to sub-para.(k). moved sub-para. k, l, and Section 5 to pg. 9-72a.	
	9-72a	Relocated sub-para. k,l and Section 5 from pg. 9-72.	
	9-72b	Added page.	
	9-73	Revised Section 1 add Abbreviations. Relocated Abbreviations from pg. 9-74.	
	9-74	Relocated Abbreviations to pg. 9-73. Revised Section 2. Relocated part of sub-para. g from pg. 9-75. Revised para. g.	
	9-75	Relcated Section 3. Added item (4) to sub-para. b. Revised item 3 of sub-para. b. relocated sub-para. 4 from pg. 9-76.	
	9-76	Revised Caution. Change Section 4 sub-para. c to d; d to e and add para. c. Relocate para. d. moved sub-para. e to pg. 9-77.	
	9-77	Relocated sub- para. e from pg. 9-26. Revised sub-para. e. Change sub-para. e to f.	
	9-78	Change sub-para. f to g and g to h. Revised sub-para. h, and added item (7). Moved caution to pg. 9-79.	
	9-79	Relocated caution from pg. 9-78. Change sub-para. h to i. Revised note and revised (i) - (4). Moved note to pg. 9-80.	
	9-80	Relocated revised note from pg. 9-79.	
	9-81	Revised item (10). Changed sub-para. i to j and j to k. Revised item (K) (3).	
	9-82	Added Note. Revised sub- para. (8) (b.). Changed sub-para. k to l and revised e.	Paul E. Everly Aug. 10, 1979
Rev. 12 - 761 594 (PR800515)	2-10	Revised para. 2.29.	
	4-9	Revised para. 4.9.	
	5-21	Revised fig. 5.21.	
	5-52	Revised fig. 5-79.	
	6-27	Item 23 added model no.	
	6-35	Item 145 added dwg. no.	
	6-37	Item 161 changed dwg. no.	
	6-43	Item 221 changed dwg. no.	
	6-50b	Added item 333.	
	6-51	Added item 347.	
	6-52	Added item 383.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approved Signature and Date
Rev. 12 - 761 594 (PR800515) (cont)	6-53	Added item 402.	
	6-56	Item 463 changed dwg. no.	
	6-57	Added new item 467; renumbered items 467 thru 471 to 468 thru 472 successively; renumbered old item 477 to 478; added new item 477; moved items 482 and 483 to pg. 6-58.	
	6-58	Relocated items 482 and 483; moved items 493 and 495 to pg. 6-59.	
	6-59	Added items 497 and 511; relocated items 493 and 495.	
	6-60	Moved item 527 to pg. 6-61.	
	6-61	Relocated item 527 from pg. 6-60; items 603 and 613 changed dwg. no.	
	7-12a	Added foot note.	
	9-66	Revised Sec. 2 (e).	
	9-68	Revised Sec. 4 (e).	PE Everly
	9-74	Revised Sec. 2 (e).	
	9-78	Revised Sec. 3 (h) (2) and (4).	Paul E. Everly
	10-2	Revised para. (r).	May 15, 1980
Rev. 13 - 761 594 (PR801010)	1-4	Revised para. 1.13.	
	4-17	Revised note.	
	6-49	Revised items 310 and 311; added item 314. Moved item 315 to pg. 6-50.	
	6-50	Relocated item 315 from pg. 6-49; Moved item 325 to pg. 6-50a.	
	6-50a	Relocated item 325 from pg. 6-50.	
	6-50b	Corrected spelling.	
	6-51	Added item 353.	
	6-52	Revised item 387.	
	6-53	Revised item 405; Renumbered item.	
	6-54	Renumbered items; revised item 420; added new item 421.	
	6-56	Revised items 463 and 465.	
	6-57	Revised items 467, 468, 469 and 470; added item 476.	
	7-i	Changed page no.; added para. 7.63.	
	7-24	Revised fig. 7-23.	
	7-27	Revised para. 7.39 and added caution, moved info. to pg. 7-29.	
	7-29	Relocated info. from pg. 7-27, moved para. 7.43 to pg. 7-31.	PE Everly
	7-31	Relocated para. 7.43 from pg. 7-29.	Paul E. Everly
	7-40	Added para. 7.63.	Oct. 10, 1980
	9-i	Added Supplement 13.	
	9-83, 9-92	Added Supplement 13 (KFC-200 with Flight Director).	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 14 - 761 594 (PR880129)	4-6	Added Warning to Before Starting Engines checklist.	
	4-7	Added Warning to Engine Run-up checklist.	
	4-8	Added Warning to Shutdown checklist.	
	4-10	Added Warning to para. 4.11.	
	4-12	Added Warning to para. 4.17.	
	4-16	Added Warning to para. 4.35.	
	6-7	Revised para. 6.5.	
	6-22	Revised para. 6.15.	
	6-25	Revised para. 6.17.	
	7-10	Revised para. 7.19.	
	8-2	Revised para. 8.3.	
	8-5	Revised Caution.	D H Trompler
	8-13	Added Caution.	D.H. Trompler
	9-88	Revised Section 4, para. (h), (5).	
	9-89	Revised Section 4, para. (i), (3).	6/17/88 Date

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SECTION 1

GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by C.A.R. 3 and FAR Part 21, Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

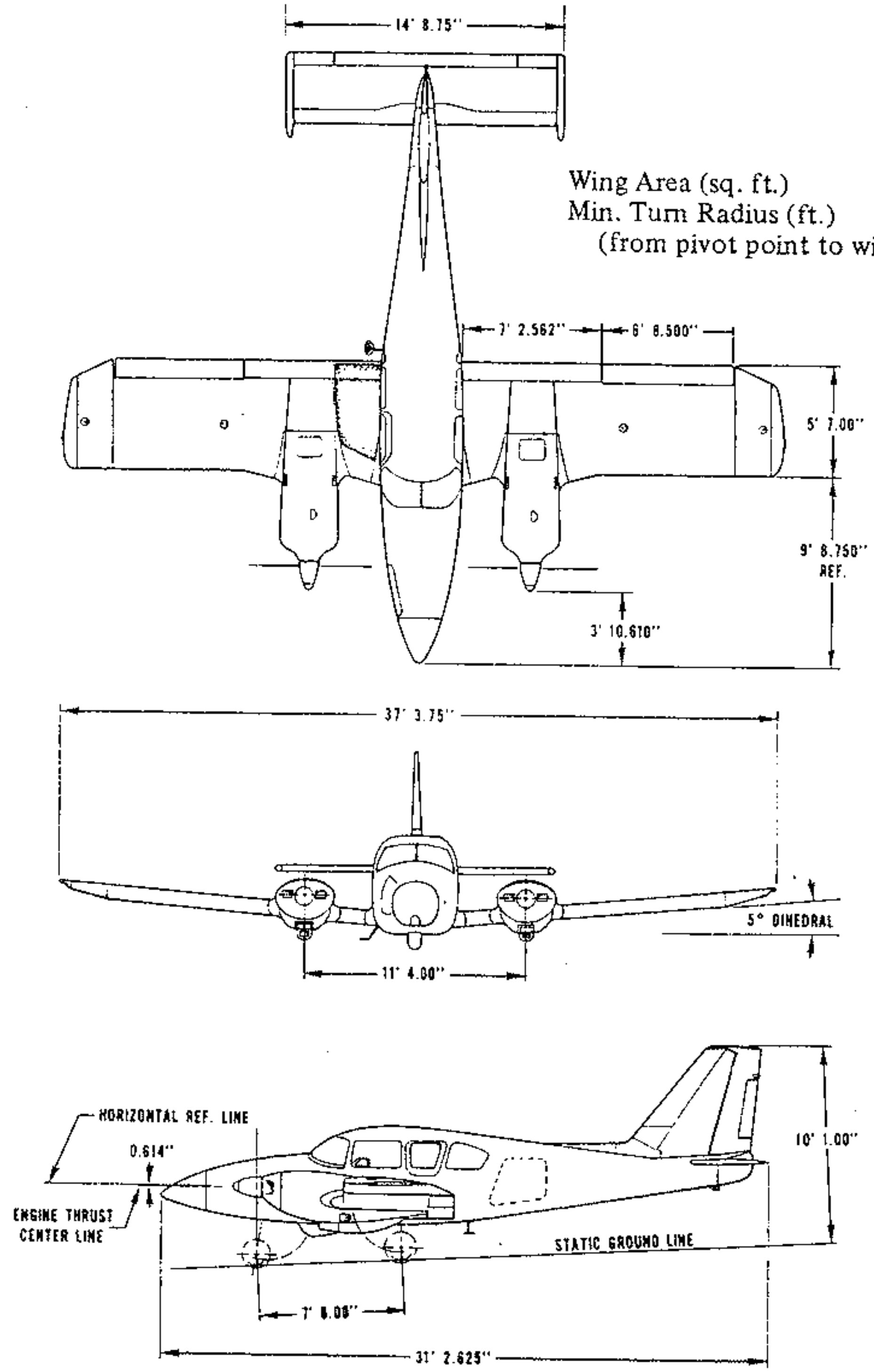
This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

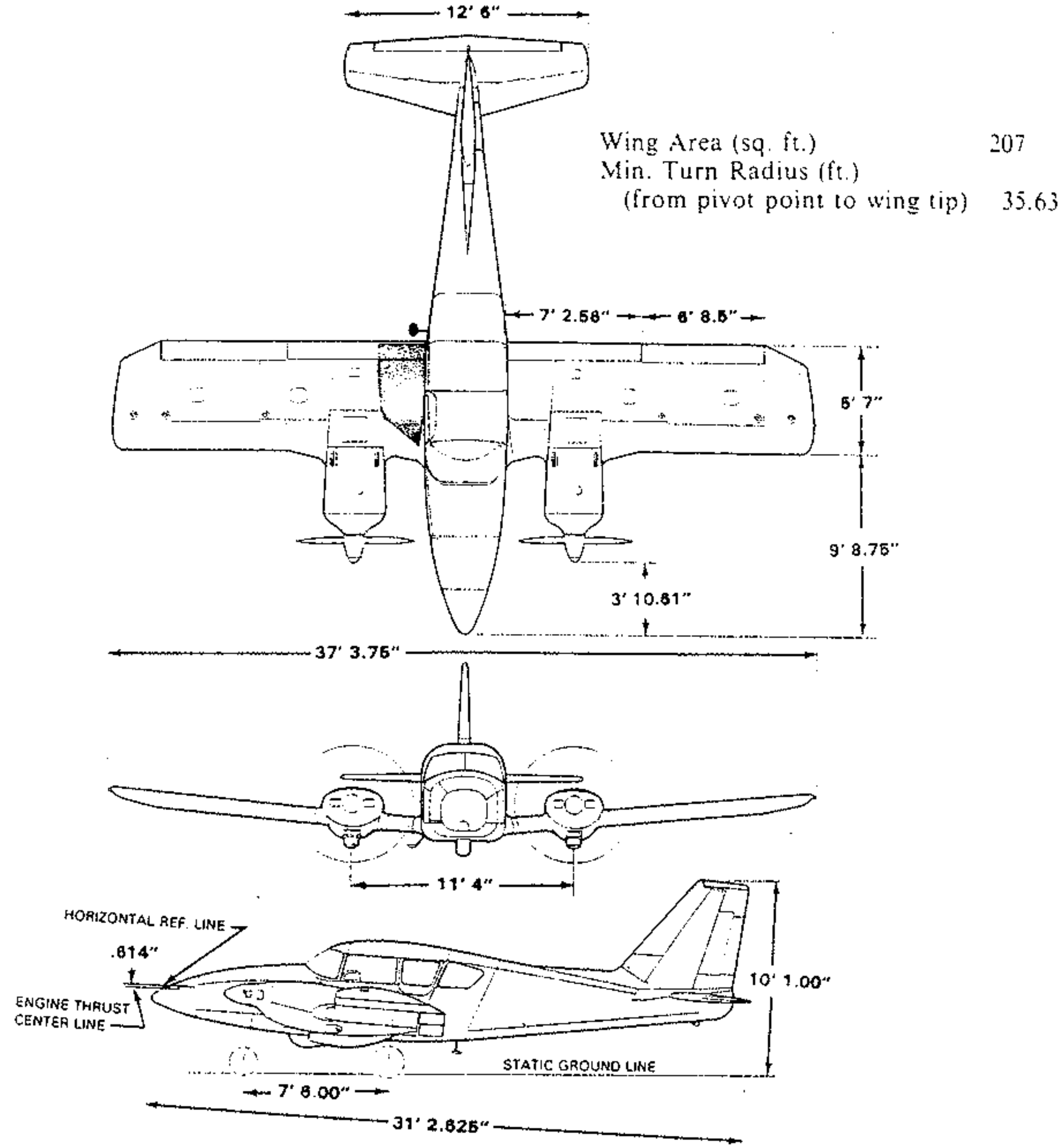
The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being left blank intentionally.

Wing Area (sq. ft.)	207
Min. Turn Radius (ft.)	
(from pivot point to wing tip)	35.63



THREE VIEW (SERIAL NUMBERS 27-7654001 THROUGH 27-7954121)

Figure 1-1



THREE VIEW (SERIAL NUMBERS 27-8054001 AND UP)

Figure 1-1a

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1.3 ENGINES

		NORMALLY ASPIRATED	TURBOCHARGED**
(a)	Number of Engines	2	2
(b)	Engine Manufacturer	Lycoming	Lycoming
(c)	Engine Model Number	IO-540-C4B5	TIO-540-C1A
(d)	Rated Horsepower	250	250
(e)	Rated Speed (rpm)	2575	2575
(f)	Bore (inches)	5.125	5.125
(g)	Stroke (inches)	4.375	4.375
(h)	Displacement (cubic inches)	541.5	541.5
(i)	Compression Ratio	8.5:1	7.2:1
(j)	Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled	

1.5 PROPELLERS

(a)	Number of Propellers	2
(b)	Propeller Manufacturer	Hartzell
(c)	Blade Model	8465-7R
(d)	Number of Blades	2
(e)	Hub Model	HC-E2YR-2
(f)	Propeller Diameter (inches)	
	(1) Maximum	77
	(2) Minimum	76
(g)	Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

(a)	Fuel Capacity (U.S. gal) (total)	
	(1) Without optional tip tanks	144
	(2) With optional tip tanks	184
(b)	Usable Fuel (U.S. gal) (total)	
	(1) Without optional tip tanks	137
	(2) With optional tip tanks	177

		NORMALLY ASPIRATED	TURBOCHARGED**
(c)	Fuel Grade, Aviation		
	(1) Minimum Octane	91/96 - Blue	100/130 - Green
	(2) Specified Octane	91/96 - Blue	100/130 - Green
		100LL - Blue	100 - Green
		100/130 - Green	100LL - Blue
		100 - Green	
	(3) Alternate Fuels*	100/130 - Green	115/145 - Purple
		115/145 - Purple	

Refer to Lycoming Service Instruction 1070, Revision J or later.

*Alternate Fuels refers to military grade with 4.6 ml of TEL. See Section 8.25 concerning use of alternate fuel grades.
**Optional equipment

1.9 OIL

(a) Oil Capacity (U.S. quarts)	12
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014.
(c) Oil Viscosity	Refer to Section 8, paragraph 8.23

1.11 MAXIMUM WEIGHTS

	NORMALLY ASPIRATED	TURBOCHARGED*
(a) Maximum Takeoff Weight (lbs)	5200	5200
(b) Maximum Landing Weight (lbs)	4940	4940
(c) Maximum Zero Fuel Weight (lbs)	4400	4500
(d) Maximum Weights in Baggage Compartments (lbs)		
(1) Forward	150	150
(2) Aft	150	150
Aft with oxygen installed*	105	105

1.13 STANDARD AIRPLANE WEIGHTS **

	NORMALLY ASPIRATED	TURBOCHARGED
(a) Standard Empty Weight (lbs): Weight of a standard airplane including unusable fuel, full operating fluids and full oil.	3184	3323
(b) Maximum Useful Load (lbs). The difference between the Maximum Takeoff Weight and the Standard Empty Weight.	2016	1877

1.15 BAGGAGE SPACE

	FORWARD	AFT
(a) Compartment Volume (cubic feet)	17.4	23.0
(b) Entry Width (inches)	30.5	31.0
(c) Entry Height (inches)	19.5	30.0

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs per sq ft)	25.1
(b) Power Loading (lbs per hp)	10.4

*Optional equipment

**These values are approximate and vary from one aircraft to another. Refer to Figure 6-7 for the Standard Empty Weight Value and the Useful Load Value to be used for C.G. calculations for the aircraft specified.

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach Number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}	Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps in takeoff position; and most rearward C.G.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.

V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_{SSE}	Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches hg. (1013 mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5° C (-69.7°F) is -0.00198°C (-0.003566° F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge

(e) Airplane Performance and Flight Planning Terminology

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
MEA	Minimum en route IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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1.21 CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
acres	0.4047	ha
	43560	sq. ft.
	0.0015625	sq. mi.
atmospheres (atm)	76	cm Hg
	29.92	in. Hg
	1.0133	bar
	1.033	kg/cm^2
	14.70	lb./sq. in.
	2116	lb./sq. ft.
bars (bar)	0.98692	atm.
	14.503768	lb./sq. in.
British Thermal Unit (BTU)	0.2519958	kg-cal
centimeters (cm)	0.3937	in.
	0.032808	ft.
centimeters of mercury at 0°C (cm Hg)	0.01316	atm
	0.3937	in. Hg
	0.1934	lb./sq. in.
	27.85	lb./sq. ft.
	135.95	kg/m^2
centimeters per second (cm/sec.)	0.032808	ft./sec.
	1.9685	ft./min.
	0.02237	mph
cubic centimeters (cm^3)	0.03381	fl. oz.
	0.06102	cu. in.
	3.531×10^{-5}	cu. ft.
	0.001	l
	2.642×10^{-4}	U.S. gal.
cubic feet (cu.ft.)	28317	cm^3
	0.028317	m^3
	1728	cu. in.
	0.037037	cu. yd.
	7.481	U.S. gal.
	28.32	l
cubic feet per minute (cu. ft./min.)	0.472	l/sec.
	0.028317	m^3/min.

MULTIPLY	BY	TO OBTAIN
cubic inches (cu. in.)	16.39	cm^3
	1.639×10^{-5}	m^3
	5.787×10^{-4}	cu. ft.
	0.5541	fl. oz.
	0.01639	l
	4.329×10^{-3}	U.S. gal.
	0.01732	U.S. qt.
cubic meters (m^3)	61024	cu. in.
	1.308	cu. yd.
	35.3147	cu. ft.
	264.2	U.S. gal.
cubic meters per minute (m^3/min.)	35.3147	cu. ft./min.
cubic yards (cu. yd.)	27	cu. ft.
	0.7646	m^3
	202	U.S. gal.
degrees (arc)	0.01745	radians
degrees per second (deg./sec.)	0.01745	radians/sec.
drams, fluid (dr. fl.)	0.125	fl. oz.
drams, avdp. (dr. avdp.)	0.0625	oz. avdp.
feet (ft.)	30.48	cm
	0.3048	m
	12	in.
	0.33333	yd.
	0.0606061	rod
	1.894×10^{-4}	mi.
	1.645×10^{-4}	NM
feet per minute (ft./min.)	0.01136	mph
	0.01829	km/hr.
	0.508	cm/sec.
	0.00508	m/sec.

MULTIPLY	BY	TO OBTAIN
feet per second (ft./sec.)	0.6818	mph
	1.097	km/hr.
	30.48	cm/sec.
	0.5921	kts.
foot-pounds (ft.-lb.)	0.138255	m-kg
	3.24×10^{-4}	kg-cal
foot-pounds per minute (ft.-lb./min.)	3.030×10^{-5}	hp
foot-pounds per second (ft.-lb./sec.)	1.818×10^{-5}	hp
gallons, Imperial (Imperial gal.)	277.4	cu. in.
	1.201	U.S. gal.
	4.546	l
gallons, U.S. dry (U.S. gal. dry)	268.8	cu. in.
	1.556×10^{-1}	cu. ft.
	1.164	U.S. gal.
	4.405	l
gallons, U.S. liquid (U.S. gal.)	231	cu. in.
	0.1337	cu. ft.
	4.951×10^{-3}	cu. yd.
	3785.4	cm^3
	3.785×10^{-3}	m^3
	3.785	l
	0.83268	Imperial gal.
	128	fl. oz.
gallons per acre (gal./acre)	9.353	l/ha
grams (g)	0.001	kg
	0.3527	oz. avdp.
	2.205×10^{-3}	lb.
grams per centimeter (g/cm)	0.1	kg/m
	6.721×10^{-2}	lb./ft.
	5.601×10^{-3}	lb./in.
grams per cubic centimeter (g/cm^3)	1000	kg/m^3
	0.03613	lb./cu. in.
	62.43	lb./cu. ft.

MULTIPLY	BY	TO OBTAIN
hectares (ha)	2.471	acres
	107639	sq. ft.
	10000	m^2
horsepower (hp)	33000	ft.-lb./min.
	550	ft.-lb./sec.
	76.04	m-kg/sec.
	1.014	metric hp
horsepower, metric	75	m-kg/sec.
	0.9863	hp
inches (in.)	25.40	mm
	2.540	cm
	0.0254	m
	0.08333	ft.
	0.027777	yd.
inches of mercury at 0°C (in. Hg)	0.033421	atm
	0.4912	lb./sq. in.
	70.73	lb./sq. ft.
	345.3	kg/m^2
	2.540	cm Hg
	25.40	mm Hg
inch-pounds (in.-lb.)	0.011521	m-kg
kilograms (kg)	2.204623	lb.
	35.27	oz. avdp.
	1000	g
kilogram-calories (kg-cal)	3.9682	BTU
	3087	ft.-lb.
	426.9	m-kg
kilograms per cubic meter (kg/m^3)	0.06243	lb./cu. ft.
	0.001	g/cm^3
kilograms per hectare (kg/ha)	0.892	lb./acre
kilograms per square centimeter (kg/cm^2)	0.9678	atm
	28.96	in. Hg
	14.22	lb./sq. in.
	2048	lb./sq. ft.

MULTIPLY	BY	TO OBTAIN
kilograms per square meter (kg/m^2)	2.896×10^{-3}	in. Hg
	1.422×10^{-3}	lb./sq. in.
	0.2048	lb./sq. ft.
kilometers (km)	1×10^{5}	cm
	3280.8	ft.
	0.6214	mi.
	0.53996	NM
kilometers per hour (km/hr.)	0.9113	ft./sec.
	58.68	ft./min.
	0.53996	kt
	0.6214	mph
	0.27778	m/sec.
	16.67	m/min.
knots (kt)	1	nautical mph
	1.689	ft./sec.
	1.1516	statute mph
	1.852	km/hr.
	51.48	m/sec.
liters (l)	1000	cm^3
	61.02	cu. in.
	0.03531	cu. ft.
	33.814	fl. oz.
	0.264172	U.S. gal.
	0.2200	Imperial gal.
	1.05669	qt.
liters per hectare (l/ha)	13.69	fl. oz./acre
	0.107	gal./acre
liters per second (l/sec.)	2.12	cu. ft./min.
meters (m)	39.37	in.
	3.280840	ft.
	1.0936	yd.
	0.198838	rod
	6.214×10^{-4}	mi.
	5.3996×10^{-4}	NM
meter-kilogram (m-kg)	7.23301	ft.-lb.
	86.798	in.-lb.
meters per minute (m/min.)	0.06	km/hr.
meters per second (m/sec.)	3.280840	ft./sec.
	196.8504	ft./min.
	2.237	mph
	3.6	km/hr.
microns	3.937×10^{-5}	in.
miles, statute (mi.)	5280	ft.
	1.6093	km
	1609.3	m
	0.8684	NM
miles per hour (mph)	44.7041	cm/sec.
	4.470×10^{-1}	m/sec.
	1.467	ft./sec.
	88	ft./min.
	1.6093	km/hr.
	0.8684	kt
miles per hour square (m/hr. sq.)	2.151	ft./sec. sq.
millibars	2.953×10^{-2}	in. Hg
millimeters (mm)	0.03937	in.
millimeters of mercury at 0°C (mm Hg)	0.03937	in. Hg
nautical miles (NM)	6080	ft.
	1.1516	statute mi.
	1852	m
	1.852	km
ounces, avdp. (oz. avdp.)	28.35	g
	16	dr. avdp.
ounces, fluid (fl. oz.)	8	dr. fl.
	29.57	cm^3
	1.805	cu. in.
	0.0296	l
	0.0078	U.S. gal.

MULTIPLY	BY	TO OBTAIN
ounces, fluid per acre (fl. oz./acre)	0.073	l/ha
pounds (lb.)	0.453592	kg
	453.6	g
	3.108×10^{-2}	slug
pounds per acre (lb./acre)	1.121	kg/ha
pounds per cubic foot (lb./cu. ft.)	16.02	kg/m^3
pounds per cubic inch (lb./cu. in.)	1728	lb./cu. ft.
	27.68	g/cm^3
pounds per square foot (lb./sq. ft.)	0.1414	in. Hg
	4.88243	kg/m^2
	4.725×10^{-4}	atm
pounds per square inch (psi or lb./sq. in.)	5.1715	cm Hg
	2.036	in. Hg
	0.06804	atm
	0.0689476	bar
	703.1	kg/m^2
quart, U.S. (qt.)	0.94635	l
	57.749	cu. in.
radians	57.30	deg. (arc)
	0.1592	rev.
radians per second (radians/sec.)	57.30	deg./sec.
	0.1592	rev./sec.
	9.549	rpm
revolutions (rev.)	6.283	radians
revolutions per minute (rpm or rev./min.)	0.1047	radians/sec.
revolutions per second (rev./sec.)	6.283	radians/sec.

MULTIPLY	BY	TO OBTAIN
rod	16.5	ft.
	5.5	yd.
	5.029	m
slug	32.174	lb.
square centimeters (cm^2)	0.1550	sq. in.
	0.001076	sq. ft.
square feet (sq. ft.)	929	cm^2
	0.092903	m^2
	144	sq. in.
	0.1111	sq. yd.
	2.296×10^{-5}	acres
square inches (sq. in.)	6.4516	cm^2
	6.944×10^{-3}	sq. ft.
square kilometers (km^2)	0.3861	sq. mi.
square meters (m^2)	10.76391	sq. ft.
	1.196	sq. yd.
	0.0001	ha
square miles (sq. mi.)	2.590	km^2
	640	acres
square rods (sq. rods)	30.25	sq. yd.
square yards (sq. yd.)	0.8361	m^2
	9	sq. ft.
	0.0330579	sq. rods
yards (yd.)	0.9144	m
	3	ft.
	36	in.
	0.181818	rod

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SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for the safe operation of the normally aspirated PA-23-250 (Six Place) Aztec F and its systems.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 AIRSPEED LIMITATIONS

SPEED	CAS KNOTS	IAS KNOTS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation	216	221
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	172	175
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.	129	131
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with a given flap setting.		
Flaps extended speeds	60 to 108	55 to 108
Full flap	108	108
Half flap	122	123
Quarter flap	139	141
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	130	132
Maximum Landing Gear Operating Speed (V_{LO}) - Do not extend or retract landing gear above this speed.	130	132
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating and no flaps.	70	64

Stall Speed	CAS KNOTS	IAS KNOTS
Gear and flaps up	67	61
Gear and flaps down	60	55
Best Single Engine Angle of Climb Speed	87	83
Best Single Engine Rate of Climb Speed	91	88

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS KNOTS
Green Arc (Normal Operating Range)	61 to 175
Yellow Arc (Caution Range - Smooth Air)	175 to 221
White Arc (Flaps Extended Range)	55 to 108
Radial Red Line (Never Exceed - Smooth Air)	221
Radial Red Line (Minimum Control Speed - Single Engine)	64
Radial Blue Line (Best Rate of Climb Speed - Single Engine)	88

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	2
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	IO-540-C4B5
(d) Engine Operating Limits	
(1) Maximum Horsepower	250
(2) Maximum Rotational Speed (RPM)	2575
(3) Maximum Manifold Pressure (Inches of Mercury)	
Below 2300 RPM	27
Below 2000 RPM	25
(4) Maximum Cylinder Head Temperature	500° F
(5) Maximum Oil Temperature	245° F
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI
(f) Fuel Flow	
Normal Operating Range (green arc)	0 to 26 GPH
Maximum at Sea Level (red line)	26 GPH (7.8 PSI)
(g) Fuel Grade (minimum octane)	91/96 - Blue
(h) Number of Propellers	2
(i) Propeller Manufacturer	Hartzell
(j) Propeller Hub Model	HC-E2YR-2
(k) Propeller Blade Model	8465-7R
(l) Propeller Diameter	
Maximum	77 IN.
Minimum	76 IN.
(m) Propeller Pitch Settings at 30 Inch Station	
Low Pitch Stop	14.5°
High Pitch Stop	80°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	500 RPM to 2575 RPM
	Red Line (Maximum)	2575 RPM
(b)	Fuel Flow	
	Green Arc (Normal Operating Range)	0 GPH to 26 GPH
	Red Line (Maximum at Sea Level)	26 GPH (7.8 PSI)
(c)	Cylinder Head Temperature	
	Green Arc (Normal Range)	200° F to 500° F
	Red Line (Maximum)	500°F
(d)	Oil Temperature	
	Green Arc (Normal Operating Range)	120°F to 245°F
	Yellow Arc (Caution)	60°F to 120°F
	Red Line (Maximum)	245°F
(e)	Oil Pressure	
	Green Arc (Normal Operating Range)	60 PSI to 90 PSI
	Yellow Arc (Caution)	25 PSI to 60 PSI and 90 PSI to 100 PSI
	Red Line (Minimum)	25 PSI
	Red Line (Maximum)	100 PSI

2.11 WEIGHT LIMITS

(a)	Maximum Takeoff Weight	5200 LBS
(b)	Maximum Landing Weight	4940 LBS
(c)	Maximum Weights in Baggage Compartments	
	Forward	150 LBS
	Aft	150 LBS
(d)	Maximum Zero Fuel Weight	4400 LBS

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Aft Limit Inches Aft of Datum
5200	99.0	100.5
5000	97.0	100.5
3540	87.6	100.5

NOTES

Straight line variation between the points given.

Datum is 80 inches ahead of the wing leading edge outboard of the tapered sections.

2.15 MANEUVER LIMITS

All intentional acrobatic maneuvers (including spins) are prohibited. Avoid abrupt maneuvers.

2.17 FLIGHT LOAD FACTOR LIMITS

(a) Positive Load Factor (Maximum) at 5200 Lbs	3.68 G
(b) Negative Load Factor (Maximum) at 5200 Lbs	-1.47 G

No Inverted Maneuvers Approved

NOTE

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. Maximum allowable landing weight is 4940 lbs. Maximum allowable gross weight is 5200 lbs. See Section 6 (Weight and Balance) for proper loading instructions.

2.19 TYPES OF OPERATION LIMITS

The Federal Aviation Regulations make the operator of an aircraft responsible for insuring that sufficient and proper instruments and equipment are installed, operating, and calibrated for the type of flight being undertaken. These regulations (for example, see FAR 91.3(a), 91.25, 91.33, 91.97, 91.170 and 91.209) also specify the minimum instruments and equipment which must be available for the various types of flight such as VFR, IFR, night, commercial, air taxi, high altitude, icing and so on. It is recommended that pilots of this aircraft make themselves familiar with these regulations in order to avoid violating them. While the regulations list minimum instruments and equipment, experienced pilots realize that the minimum practical instruments and equipment depends on the pilot's capability, weather, terrain, the flight plan, facilities to be used, whether flight is during daylight or night, at high or low altitude, for hire or not, in icing conditions or not, and so on. Pilots are cautioned to consider all factors in determining whether they have all the required equipment for making a particular flight.

When properly equipped this airplane may be flown day or night, VFR or IFR.

The certificating regulations of the FAA for this airplane require the manufacturer to specify in the Aircraft Flight Manual the types of operation for which the airplane is equipped.

The equipment installed in this aircraft has been substantiated to 24,000 feet.

When this airplane was delivered it contained the properly installed equipment listed in the Weight and Balance Section of this manual and, therefore, was satisfactory for the types of operation indicated below by an asterisk.

(a)_____ Day VFR

(b)_____ Night VFR

(c)_____ Day and night IFR when adequate communication and navigation radio has been installed in an FAA approved manner.

(d)_____ Flight in icing conditions.

Operators are warned that if any of the equipment listed as having been installed at time of delivery is changed, not operating, or not properly maintained and calibrated, the airplane may not be properly equipped for all the conditions noted above. It is the responsibility of the pilot to determine whether the lack of a piece of equipment limits the conditions under which he may fly the airplane.

AIRCRAFT

________________________ ________________________

REGISTRATION NO. SERIAL NO.

Owners desiring to make changes or additions to the equipment must have these modifications done in an FAA-approved manner. All PA-23-250 (six place) aircraft are delivered equipped for day VFR flight.

The performance, handling qualities and structure of the airplane are approved for instrument flight.

If an owner of an airplane which is approved for VFR flight only desires to extend his operations to IFR, he should have radio equipment installed in accordance with Piper-approved drawings or other FAA-approved data (or data approved by the aviation agency of the country of registration). The owner should insure that the radio equipment is adequate for the ground facilities to be used, is of sufficiently high quality and reliability, is properly functioning, adjusted and calibrated, and that it is compatible with previously installed equipment before authorizing it to be flown under instrument conditions.

When the original equipment or FAA-approved equivalent equipment is installed as originally or in an FAA-approved manner, is functioning properly, and is calibrated in accordance with the Federal Aviation Regulations, and when adequate radio communications and navigation equipment is installed as indicated above, this airplane is approved for day and night VFR and IFR flight.

Pilots are also reminded that oxygen must be available to passengers and crew for flights to high cabin altitudes and that special electronic equipment is required for flight above specified altitudes.

Unless complete approved icing equipment is installed and operative, this airplane may not be flown in icing conditions.

FAR 135 places special requirements on air taxi and commercial operators.

In accordance with the FAR's, this airplane is not properly equipped for the condition of flight indicated if any of the equipment listed below is not properly installed, functioning, properly maintained and calibrated according to the FAR's. The pilot is responsible for assuring compliance with the latest ammendments to FAR 91 concerning required equipment.

(a) Day VFR
- (1) Airspeed indicator
- (2) Altimeter
- (3) Magnetic direction indicator
- (4) Tachometer - each engine
- (5) Oil pressure gauge - each engine
- (6) Oil temperature gauge - each engine
- (7) Manifold pressure indicator - each engine
- (8) Fuel gauges
- (9) Fuel flow indicator - each engine
- (10) Landing gear position indicators
- (11) Seat belts - each occupant
- (12) Flares and flotation gear over water, if for hire
- (13) Emergency locator transmitter (ELT)
- (14) Encoding altimeter for flight above 12,500 feet
- (15) Transponder for flight in controlled air space

(b) Night VFR
   (1) All equipment required for Day VFR
   (2) Position lights
   (3) Anti-collision lights
   (4) Alternator - each engine
   (5) Instrument lights
   (6) Landing light, if for hire

(c) Day and Night IFR
   (1) All equipment required for Night VFR
   (2) Two-way radio for communication
   (3) Suitable and adequate navigation radio equipment
   (4) Gyroscopic rate of turn indicator
   (5) Bank indicator
   (6) Clock with sweep second hand
   (7) Sensitive altimeter adjustable for barometric pressure
   (8) Starter and electric power generator - each engine
   (9) Gyroscopic bank and pitch indicator
   (10) Gyroscopic direction indicator
   (11) Free air temperature indicator

NOTE

This aircraft is not approved for continuous flight in icing conditions unless all required icing equipment is installed and operable. (See Section 9, Supplement 6, for required icing equipment.)

2.21 FUEL LIMITATIONS

(a) Usable fuel per tank	34.3 GAL.
(b) Unusable fuel per tank	1.7 GAL.

When the optional interconnected tip/outboard tanks are installed (per Piper Drawing 33826), the usable fuel is 34.3 gallons in the inboard tanks and 54.3 gallons in the outboard tanks.

2.23 COWL FLAPS LIMITATIONS

Cowl flaps are provided to allow manual control of engine temperatures. The cowl flaps should be open during ground operations and in climbs. In no case should the cylinder head temperature be allowed to exceed 500°F or the oil temperature to exceed 245°F. The cowl flaps must be fully open during climbs above 18,000 feet when an alternator is loaded to 60 amps or more.

2.25 WING FLAPS LIMITATIONS

Takeoff	0°
Landing	0° to 50°

2.27 CREW LIMITS

The minimum crew for operating this airplane is one pilot.

2.28 NOISE LEVEL

The corrected noise level of this aircraft measured with IO-540-C4B5 engines is 75.7d BA.

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The above statement notwithstanding, the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

2.29 PLACARDS

On the instrument panel in full view of the pilot:

"THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE AIRPLANE FLIGHT MANUAL. ACROBATIC MANEUVERS (INCLUDING SPINS) PROHIBITED."

On the instrument panel:

"MINIMUM SINGLE ENGINE CONTROL SPEED 64 KIAS"
"MAXIMUM SPEED FOR LANDING GEAR OPERATION 132 KIAS"
"DESIGN MANEUVERING SPEED 131 KIAS"

Under both center windows:

"LATCH SEATS FOR TAKEOFF AND LANDING"

On firing ring cover of emergency landing gear extender under left front seat: (serial numbers 27-7654001 through 27-7954121):

"EMERGENCY GEAR EXTENDER. PLACE GEAR SELECTOR TO DOWN POSITION LIFT COVER, PULL RING"

On forward baggage compartment door:

CAUTION

BE CERTAIN BAGGAGE DOORS
ARE PROPERLY CLOSED AND
LOCKED PRIOR TO FLIGHT

MAX. FLOOR LOAD
100 LBS. PER SQ. FOOT
TOTAL COMPARTMENT CAPACITY
150 LBS.

BAGGAGE/CARGO MUST BE LOADED
WITHIN THE WEIGHT AND BALANCE LIMITS
OF THIS AIRCRAFT

On rear baggage compartment door:

CAUTION

BE CERTAIN BAGGAGE DOORS
ARE PROPERLY CLOSED AND
LOCKED PRIOR TO FLIGHT

MAX. FLOOR LOAD
100 LBS. PER SQ. FOOT
TOTAL COMPARTMENT CAPACITY
150 LBS.
INCLUDES 20 LBS. ON SHELF

BAGGAGE/CARGO MUST BE LOADED
WITHIN THE WEIGHT AND BALANCE LIMITS
OF THIS AIRCRAFT

NOTE

See oxygen system supplement for additional limitation if oxygen equipment installed.

On emergency exit, middle window left side:

"EMERGENCY EXIT RELEASE: REMOVE COVER, TURN HANDLE, PUSH DOOR"

On right sun visor, (Power Chart) (required on normally aspirated models only):

"DO NOT EXCEED 27" MANIFOLD PRESSURE BELOW 2300 RPM OR 25" BELOW 2000 RPM"

On left window moulding in full view of the pilot:

WARNING

TURN OFF ANTI-COLLISION LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

STANDARD POSITION LIGHTS TO BE ON FOR ALL NIGHT OPERATIONS.

On cabin door panel, auxiliary latch:

ENGAGE LATCH BEFORE FLIGHT
OR
ENGAGE LATCH BEFORE FLIGHT
PUSH FORWARD TO UNLATCH

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SECTION 3

EMERGENCY PROCEDURES

SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided in this section. All of the required (FAA regulations) emergency procedures and those necessary for the safe operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided in Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency check list which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section presents amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

These procedures are suggested as a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

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3.3 EMERGENCY CHECK LIST

SPEEDS

Air Minimum Control . . . . 64 KIAS
Best Single Engine Angle of Climb . . . . 83 KIAS
Best Single Engine Rate of Climb . . . . . 88 KIAS
Maneuvering . . . . 131 KIAS
Never Exceed . . . . 221 KIAS

ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Throttle . . . . close
Propeller . . . . FEATHER (1000 RPM min.)
Mixture . . . . IDLE CUT-OFF
Cowl flaps . . . . Close
Magneto switch . . . . OFF
Electric fuel pump . . . . OFF
Fuel selector . . . . OFF (detent)
Alternator switch . . . . OFF
Prop. Sync. . . . . OFF
Electrical load . . . . reduced
Crossfeed . . . . considered

NOTE

(Serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is not installed) Hydraulic pump on left engine only. Use hand pump to actuate gear and flaps when left engine is out. Gear can be extended with hand pump or by CO_2*.

ENGINE FAILURE DURING TAKEOFF (Below 64 KIAS)

If sufficient runway remains for a safe stop:
Throttles . . . . CLOSE immediately
Brakes . . . . as required
Stop straight ahead.

If insufficient runway remains for a safe stop:
Throttles . . . . close immediately
Mixture . . . . retard fully aft
Master switch . . . . OFF
Fuel selectors . . . . OFF
Magneto switches . . . . OFF
Maintain directional control and maneuver to avoid obstacles.

*CO_2 system installed on aircraft serial numbers 27-7654001 through 27-7954121 only.

ENGINE FAILURE DURING TAKEOFF (Between 64 KIAS and 83 KIAS)

Decide whether to abort or continue
If abort . . . . follow above procedures
If continue . . . . accelerate inground effect (near ground) to 83 KIAS and follow below procedures

WARNING

Certain combinations of aircraft weight, configuration, ambient conditions and speeds will not permit positive climb.

ENGINE FAILURE DURING TAKEOFF (83 KIAS or above)

Airspeed . . . . 83 KIAS minimum
Directional control . . . . maintain
Power . . . . maximum
Gear . . . . RETRACT (Serial numbers 27-7654001 thru 27-7854050, when Piper Kit No. 763 836 is not installed, if left engine failed, gear must be raised with hand pump)
Flaps . . . . insure UP
Prop. (inop. eng.) . . . . FEATHER
Cowl flap (inop. eng.) . . . . CLOSE
Airspeed . . . . when clear of obstacles accelerate to 88 KIAS
Trim . . . . bank 5° toward oper. eng.
Cowl flap (operative eng.) . . . . . CLOSE (as much as possible)
Climb . . . . straight ahead (avoiding obstacles and attain sufficient altitude to execute single engine landing procedure
Inop. engine . . . . complete Engine Securing Procedure
Land as soon as practical at nearest suitable airport.

ENGINE FAILURE DURING CLIMB

Airspeed . . . . maintain 88 KIAS
Directional control . . . . maintain
Inop. engine . . . . identify and verify
Inop. engine . . . . complete Engine Securing Procedure
Land as soon as practical at nearest suitable airport.

ENGINE FAILURE DURING FLIGHT
(Below 64 KIAS)

Rudder . . . . .apply towards operative engine
Throttles (both engines) . . . . . retard to stop turn
Pitch attitude . . . . .lower nose to accelerate above 64 KIAS
Operative eng. . . . . increase power as airspeed increases above 64 KIAS

If altitude permits, a restart may be attempted.

If restart fails or altitude does not permit:
Inop. eng. prop . . . . FEATHER
Trim . . . . .adjust 5° toward operative eng.
Inop. eng. . . . . .complete Engine Securing Procedure
Cowl flap (operative eng.) . . . . as required

ENGINE FAILURE DURING FLIGHT
(Above 64 KIAS)

Inop. eng. . . . . .identify
Operative eng. . . . . adjust as required

Before securing inop. engine:
Fuel flow . . . . check (if deficient - electric fuel pump ON)
Fuel quantity . . . . check
Fuel selector (inop. eng.) . . . . .switch to other tank containing fuel
Oil pressure and temp. . . . . check
Magneto switches . . . . check

If engine does not start, complete Engine Securing Procedure.

Power (operative eng.) . . . . as required
Mixture (operative eng.) . . . . . . .adjust for power
Fuel quantity (operative eng. tank) . . . . sufficient
Electric fuel pump (operative eng.) . . . . as required
Cowl flap (operative eng.) . . . . as required
Trim . . . . .adjust 5° toward operative eng.
Electrical load . . . . decrease to min. required

Land as soon as practical at nearest suitable airport.

SINGLE ENGINE LANDING

Inop. engine . . . . Engine Securing Procedure complete
Hydraulic pump . . . . check
Seat belts/harnesses . . . . secure
Heater . . . . .FAN position
Electric fuel pump (operative eng.) . . . . .ON
Mixture (operative eng.) . . . . RICH
Propeller (operative eng.) . . . . . full FORWARD
Fuel quantity . . . . check
Cowl flap (operative eng.) . . . . as required
Fuel selector (operative eng.) . . . . .ON
Crossfeed . . . . .OFF
Airspeed . . . . maintain 98 KIAS min. until landing is assured
Altitude . . . . higher than normal until landing is assured

When landing is assured:

NOTE
(Serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is not installed)
If the engine is inoperative the flaps must be lowered with the emergency hand pump and the gear must be extended with the emergency hand pump or CO_2 system.*

Gear . . . . DOWN
Flaps . . . . DOWN
Power . . . . retard slowly and flare airplane
Trim . . . . as power is reduced (airplane will yaw in direction of operative engine)

*Serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is not installed are equipped with a single hydraulic pump on the left engine only.

SINGLE ENGINE GO-AROUND

Avoid if possible.

On aircraft with serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is not installed, do not attempt if gear or flaps are extended and left propeller is feathered. With left engine inoperative gear and flaps must be retracted with hand pump.*

Airspeed . . . . hold 88 KIAS
Power . . . . max. on operating engine
Flaps . . . . retract
Landing gear . . . . retract
Cowl flaps and trim . . . . as required

AIR START (UNFEATHERING PROCEDURE)

Fuel selector . . . . ON
Throttle . . . . open 1/2 inch
Mixture . . . . RICH
Elect. fuel pump . . . . prime then OFF
Propeller . . . . forward
Magnetos . . . . ON
Starter . . . . engage until prop unfeathers
Propeller . . . . pull back to low RPM position as propeller speed accelerates through 1000 RPM
Throttle . . . . reduced power till warm; 2000 RPM max.
Engine instruments . . . . check
Alternator . . . . ON

OVERSPEEDING PROPELLERS

Throttle . . . . retard
Airspeed . . . . .reduce
Throttle . . . . add slowly after RPM is under control
Airspeed . . . . .maintain below airspeed at which overspeed occurred (select lower RPM if higher airspeed required)
Descend at 2200 RPM
Land with prop set at 2400 RPM

NOTE

Prop will not feather while overspeeding; therefore while in the overspeed condition do not select feather position and do not shut down engine. Propeller will feather normally if not overspeeding.

ENGINE ROUGHNESS

Electric fuel pumps . . . . ON
Engine instruments . . . . scan for cause
Mixture . . . . adjust as required
Alternate air . . . . OPEN
Cowl flaps . . . . .adjust for proper CHT
Fuel . . . . switch tanks if fuel in second tank
Magnetos . . . . check

ENGINE OVERHEAT

Cowl flaps . . . . OPEN
Mixture . . . . richen
Power . . . . .reduce
Airspeed . . . . increase (if altitude permits)

LOSS OF OIL PRESSURE

Engine . . . . secure per Engine Securing Procedure

ROUGH AIR OPERATION

Slow to maneuvering speed or slightly less (5200 lbs. 131 KTS)
Fly attitude and avoid abrupt maneuvers
Seat belt and shoulder harness - tighten.

*Serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is not installed are equipped with a single hydraulic pump on the left engine only.

EMERGENCY GEAR EXTENSION

EXTENDING GEAR WITH HAND PUMP

132 KIAS max. gear down speed.

Gear handle . . . . DOWN
Emergency hand pump . . . . .pull out and pump until 3 green lights and handle returns to neutral

EXTENDING GEAR WITH CO_2 (SERIAL NUMBERS 27-7654001 THROUGH 27-7954121 ONLY)

132 KIAS max. gear down speed

Gear handle . . . . DOWN
Ring cover . . . . raise
Ring . . . . pull
Do not attempt to raise gear hydraulically.

MANUAL EXTENSION OF WING FLAPS

Flap control . . . . down
Emergency hand pump . . . . .pull out and pump

ENGINE FIRE ON GROUND (Engine start, taxi and takeoff with sufficient distance remaining to stop)

Fuel selector .OFF
Electrical fuel pump . . . . .OFF
Brakes . . . . as required
Throttle . . . . .open
Radio . . . . call for assistance
Mixture (if fire continues) . . . . . IDLE CUT-OFF
External fire extinguisher . . . . .use

NOTES

If fire continues, shut down both engines and evacuate.

If fire is on the ground, it may be possible to taxi away.

ENGINE FIRE IN FLIGHT

Mixture . . . . idle cut-off
Electric fuel pump . . . . .OFF
Fuel selector .OFF
Propeller . . . . feather
Good engine . . . . increase power
Drag . . . . .reduce (gear, flaps, cowl flaps)
Alternator . . . . .OFF
Magnetos . . . . .OFF
Electrical load . . . . .reduce
If fire persists, increase airspeed as much as possible in an attempt to blow out fire.

Loss of power procedures . . . . complete
Land at nearest suitable airport.

CABIN FIRE

Vents . . . . closed
Heater . . . . .OFF
Fire extinguisher . . . . .use
(When fire is out ventilate the cabin)

ELECTRICAL FIRE

Flashlight (night) . . . . in hand
Master switch .OFF
Circuit breakers . . . . check, then pull all
Electrical switches . . . . all OFF
Avionics . . . . all OFF
Heater . . . . .OFF
Ventilators . . . . close
Fire extinguisher . . . . .use
(when fire is out)
Master switch . . . . .ON
Ventilators . . . . .open
Switches and circuit breakers . . . . ON, one at a time

EMERGENCY DESCENT

Throttles . . . . .retard slowly to idle
Propellers . . . . .controls forward
Dive at 172 knots . . . . . . (131 KTS in rough air)
Cowl flaps . . . . closed

GOING INTO CROSSFEED

(To use fuel from opposite side during single engine operation)

Fuel Selector
(inop. engine side) . . . . . . (inbd or outbd) ON
Electric fuel pump
(inop. side) . . . . .ON
Crossfeed valve .ON
Electric fuel pump
(operative side) . . . . OFF
Fuel selector
(operative side) . . . . OFF

COMING OUT OF CROSSFEED

When one engine is inoperative

Fuel selector
(operative engine side) . . . . .ON
Electric fuel pump
(operative side) . . . . .ON
Electric fuel pump
(inop. side) . . . . OFF
Crossfeed valve . . . . OFF
Fuel selector
(inop. side) . . . . OFF
Fuel pump (operative
side) . . . . as required

ONE ALTERNATOR INOPERATIVE LIGHT ON

Reduce electrical load to minimum required
Turn OFF same side of master switch
Reset tripped circuit breakers
Master switch (both sides) ON
If light goes out, reinstate electrical load.
If light stays on, turn same side of master switch OFF and continue with reduced electrical load.

BOTH ALTERNATOR INOPERATIVE LIGHTS ON

Repeat above procedure for each alternator.

If both lights fail to go off:

a. Master switch . . . . both sides ON
b. Alternator circuit
breaker switches . . . . OFF
c. Terminate flight as
soon as possible

NOTE

Since battery is furnishing all the current, keep the load low.

DOOR OPEN IN FLIGHT

Airspeed . . . . slow to reduce buffeting
Land at nearest airport

SPIN RECOVERY

Throttles . . . . .retard both to idle
Rudder . . . . full opposite to spin until rotation stops
Control wheel . . . . .neutral; then full forward if necessary
Ailerons . . . . neutral
Smoothly recover from dive when spin stops.

NOTE

Inasmuch as FAA Regulations do not require spin demonstrations of airplanes of this weight, no spin tests have been conducted. The recovery technique is based on the best available information.

AIRFRAME VIBRATION

Reduce airspeed till vibration stops
Handle controls smoothly and gently
Land and investigate cause

GEAR UP LANDING

Normal check list . . . . complete (except for gear selector)
Gear selector . . . . UP
Make normal approach with power
Close throttles before touchdown
Turn OFF master and magneto switches
Turn OFF fuel valves
Touch down at minimum speed
(If time permits, use starter to position props parallel with wings.)

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3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.7 ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

The engine securing procedure should always be accomplished in a sequential order according to the nature of the engine failure (ie., practice, engine failure during takeoff, engine failure during climb, etc.).

Begin the securing procedure by closing the throttle of the inoperative engine and moving its propeller control to "FEATHER" (fully aft) before the propeller speed drops below 1000 rpm. The inoperative engine mixture control should be moved fully aft to the "IDLE CUT-OFF" position. "CLOSE" its cowl flaps to reduce drag. Turn "OFF" the magneto switches, the electric fuel pump switch, the fuel selector and the alternator switch of the inoperative engine. The propeller synchrophaser (if installed) should be OFF. Complete the procedure by reducing the electrical load and considering the use of the fuel crossfeed if the fuel quantity dictates.

NOTE

On aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed only one hydraulic pump supplies pressure for the system. This pump is installed on the left engine. When the left engine is secured, the flaps must be actuated by the hand pump and operation of the gear is limited to the hand pump or CO_2 system.

ENGINE FAILURE DURING TAKEOFF (Below 64 KIAS)

A preflight determination of runway length and computation of accelerate/stop distance will aid in determining the best course of action in the event of an engine failure during takeoff. If engine failure occurs while sufficient runway remains for a deceleration and a safe stop, cut power immediately and stop straight ahead.

If an engine failure occurs before an airspeed of 64 KIAS is attained, and there is not adequate runway remaining for deceleration and a stop, immediately retard the throttle and mixture levers fully aft. Turn OFF the master switch, the fuel selectors, and the magneto switches. During these procedures, maintain directional control and maneuver to avoid obstacles if necessary.

ENGINE FAILURE DURING TAKEOFF (Between 64 KIAS and 83 KIAS)

If an engine fails during takeoff at an airspeed between 64 KIAS and 83 KIAS, and there is not sufficient runway remaining for deceleration, the pilot must decide whether to abort the takeoff following the above procedures or to continue takeoff and climb on a single engine. The pilot's decision must be based upon a personal judgement, taking into consideration such factors as remaining runway, obstacles, the type of terrain beyond the runway, density altitude, weight and loading, weather, other associated conditions, airplane condition, and the pilot's own proficiency and capability. If the decision is to continue the takeoff on a single engine, the airplane should be accelerated in ground effect (near the ground) to 83 KIAS, at which point the below procedures should be followed.

WARNING

Certain combinations of aircraft weight, configuration, ambient conditions and speeds will not permit positive climb.

ENGINE FAILURE DURING TAKEOFF (83 KIAS or above)

If engine failure occurs when the airspeed is above 83 KIAS, or if the airspeed is between 64 KIAS and 83 KIAS and the pilot has decided to continue takeoff, the first step before attempting climb is to reach and maintain a minimum airspeed of 83 KIAS. Since one engine will be inoperative and the other will be at maximum power, the airplane will want to turn in the direction of the inoperative engine. Rudder pedal force on the side of the operating engine will be necessary to maintain directional control. Once committed to takeoff, maintain maximum power and retract the landing gear. Once the faulty engine is identified and its power loss verified, its propeller should be feathered. Directional tendency will identify the faulty engine, and observing response to a retarded throttle will verify the loss of power. Be sure to maintain maximum power on the good engine. After feathering the propeller on the inoperative engine, close its cowl flap. When clear of obstacles accelerate to the best single-engine rate of climb speed (88 KIAS), trim as necessary, and close the cowl flap on the operating engine as much as possible without exceeding engine temperature limits. After a climb has been established, complete the "Engine Securing Procedures." Continue a straight ahead climb until sufficient altitude (minimum of 1000 feet above ground elevation) is reached to execute the normal single-engine landing procedure at the nearest suitable airport.

ENGINE FAILURE DURING CLIMB

If engine failure occurs during climb, a minimum airspeed of 88 KIAS should be maintained. Since one engine will be inoperative and the other will be at maximum power, the airplane will want to turn in the direction of the inoperative engine. Rudder pedal force on the side of the operating engine will be necessary to maintain directional control. After the faulty engine has been identified and power loss verified, complete the "Engine Securing Procedures." Continue a straight ahead climb until sufficient altitude (minimum of 1000 feet above ground elevation) is reached to execute the normal "Single Engine Landing" procedure at the nearest suitable airport.

ENGINE FAILURE DURING FLIGHT (Below 64 KIAS)

Should an engine fail during flight at an airspeed below 64 KIAS, apply rudder towards the operative engine to maintain directional control. The throttles should be retarded to stop the yaw force produced by the inoperative engine. Lower the nose of the aircraft to accelerate above 64 KIAS and increase the power on the operative engine as the airspeed exceeds 64 KIAS.

After an airspeed above 64 KIAS has been established, an engine restart attempt may be made if altitude permits. If the restart has failed, or altitude does not permit, the engine should be secured. Move the propeller control of the inoperative engine to FEATHER and complete the "Engine Securing Procedure." Adjust the trim to 5°of bank toward the operating engine. The cowl flap on the operative engine should be adjusted as required to maintain engine temperature within allowable limits.

ENGINE FAILURE DURING FLIGHT (Above 64 KIAS)

If an engine fails at an airspeed above 64 KIAS during flight, begin corrective response by identifying the inoperative engine. The operative engine should be adjusted as required after the loss of power has been verified. Once the inoperative engine has been identified and the operating engine adjusted properly, an engine restart may be attempted if altitude permits.

Prior to securing the inoperative engine, check to make sure the fuel flow to the engine is sufficient. If the fuel flow is deficient, turn ON the electric fuel pump. Check the fuel quantity on the inoperative engine side and switch the fuel selector to the other tank if a sufficient supply is indicated. Check the oil pressure and oil temperature and insure that the magneto switches are ON.

If the engine fails to start it should be secured using the "Engine Securing Procedure."

After the inoperative engine has been secured, the operative engine can be adjusted. Power should be maintained as required and the mixture control should be adjusted for power. Check the fuel supply and turn ON the electric fuel pump if necessary. The cowl flaps on the operative engine should be adjusted as required to maintain engine temperatures within allowable limits. Trim 5° toward the operating engine. The electrical load should be decreased to a required minimum. Land as soon as practical at the nearest suitable airport.

SINGLE ENGINE LANDING

If a single-engine landing is necessary, a check should be performed to determine whether or not the hydraulic pump(s) is functioning for normal gear extension. This check is accomplished by placing the landing gear control in the "UP" position with the gear retracted. If the hydraulic pump is functioning, pressure will return the control to the neutral position. This check should be performed before entering the traffic pattern so that there will be time to pump the gear down with the hand pump or to employ the emergency CO_2* gear extension system if necessary.

The "Engine Securing Procedure" should be complete on the inoperative engine. Fasten the seat belts and shoulder harnesses and select the FAN position of the heater switch. The operative engine electric fuel pump should be ON and the mixture RICH. Advance the propeller control (operative engine) full forward. Check to ensure that the fuel supply is sufficient. The cowl flaps on the operative engine should be adjusted as required. Insure that the fuel selector is ON and that the fuel crossfeed valve is OFF.

Maintain an airspeed of 98 KIAS or above and an altitude higher than normal until a landing is assured. When a landing is assured, extend the gear and flaps. On aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed and the left engine is inoperative the flaps must be lowered with the emergency hand pump and the gear must be extended with the emergency hand pump or CO_2* system. Slowly retard the power on the operative engine and flare out the airplane for a normal landing. Trim as necessary as power is reduced. The airplane will tend to yaw toward the operative engine.

*CO_2 system installed on aircraft serial numbers 27-7654001 through 27-7954121 only.

SINGLE ENGINE GO-AROUND

A single engine go-around should be avoided if at all possible. On aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed, do not attempt a go-around if gear or flaps are extended and the left propeller is feathered.* A final approach speed of 88 KIAS will place the airplane in the best configuration should a go-around be necessary.

To execute a single engine go-around, advance mixture, throttle, and propeller controls fully forward for maximum power on the operating engine. Retract flaps and landing gear. Maintain the airspeed at or above 88 knots IAS. Set the trim and cowl flaps as required.

WARNINGS

A go-around should not be attempted after the airspeed is decreased below the best single engine angle of climb speed (83 KIAS).

On aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed and the left engine is inoperative, operation of the landing gear and/or flaps is limited to the use of the hydraulic hand pump.*

AIR START (UNFEATHERING PROCEDURE)

When unfeathering a propeller, first turn "ON" the fuel selector of the inoperative engine side. Open the throttle 1/2 inch. If the engine has been inoperative long enough to cool down, prime the engine by moving its mixture control to full "RICH" and turning its electric fuel pump "ON" until the first indication of fuel flow on the gauge; then turn the electric fuel pump "OFF." Move the propeller control full forward and turn "ON" the magnetos. Engage the starter until the propeller is unfeathered. As the RPM passes 1000 coming out of feather, pull the propeller control back to the low RPM position to prevent excessive engine speed. Maintain the engine speed between 1800 and 2000 RPM, not exceeding 2000 RPM. This low power setting must be held until the engine is warmed up and oil pressure and temperature are stabilized within limits. Turn the alternator "ON."

3.9 OVERSPEEDING PROPELLER

If a propeller overspeed condition occurs, retard the throttle and reduce airspeed until the RPM is under control. When the RPM is under control, slowly advance the throttle. Maintain airspeed below that at which the overspeed condition occurred. If a higher airspeed is required for safe flight, select a suitable power setting with a lower RPM setting and higher manifold pressure.

If propeller overspeeding has occurred, descend at 2200 RPM and land with the propeller set at 2400 RPM.

NOTE

A propeller will not feather while overspeeding. Therefore, while in an overspeed condition, do not select the feather position and do not shut down the engine. The propeller will feather normally if not overspeeding.

*Serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed are equipped with a single hydraulic pump on the left engine only.

3.11 ENGINE ROUGHNESS

If an engine falters or runs erratically, the cause may be fuel flow interruption, fuel contamination, icing or air starvation, or ignition problems. If roughness occurs, turn the electric fuel pumps "ON." Scan the engine instruments to see if the cause can be determined. Adjust the mixture controls for maximum smoothness; if the mixture is too rich or too lean, engine roughness may result. Open the alternate air control; a blocked induction system can cause roughness. If cylinder head temperatures are too high or too low, adjust the cowl flaps as required.

If the problem is in the fuel system, selecting another tank containing fuel may remedy the situation. A check of the magnetos will determine if they are operating properly.

3.13 ENGINE OVERHEAT

If engine temperatures become excessive, open the cowl flaps. Enriching the mixture and reducing power will also reduce engine temperature. If a more rapid reduction of engine temperature is desired, increase the airspeed by establishing a shallow dive.

3.15 LOSS OF OIL PRESSURE

Loss of oil pressure could be caused by a faulty pump, oil exhaustion, or a leak. A loss of oil pressure indication could be the result of a faulty gauge. In any event, continued operation of the engine could result in a serious emergency situation or severe engine damage.

Complete the "Engine Securing Procedure" (paragraph 3.7) on the faulty engine.

3.17 ROUGH AIR OPERATION

In conditions of extreme turbulence, slow the airplane to maneuvering speed or slightly less. Maneuvering speed will decrease with the weight of the airplane - e.g., 131 KIAS at 5200 lbs., 112 KIAS at 3600 lbs. A reduction in speed will ease the stress to which the airplane is subjected by turbulence. Fly attitude and avoid abrupt maneuvers. Fasten seat belts and shoulder harnesses as a precaution against buffeting and lurching. When flying in extreme turbulence or strong vertical currents and using the autopilot, the altitude-hold mode should not be used.

3.19 EMERGENCY GEAR EXTENSION

EXTENDING GEAR WITH HAND PUMP

To extend the landing gear manually with the hand pump, move the gear selector to the "DOWN" position. Pull the hand hydraulic pump handle fully aft and pump until three green gear indicator lights illuminate and the gear selector handle returns to neutral.

EXTENDING GEAR WITH CO_2 (SERIAL NUMBERS 27-7654001 THROUGH 27-7954121 ONLY)

Use the emergency CO_2 gear extension system only if the engine-driven and hand hydraulic pumps fail. The system may also be used on aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed, if rapid gear extension is required for an emergency landing when the left engine is inoperative. The maximum gear down speed is 132 KIAS.

To extend the gear with the emergency CO_2 system, first place the gear selector in the "DOWN" position. Raise the firing ring cover under the left front seat and pull the ring as far as possible. Do not then attempt to raise the gear hydraulically.

NOTE

Any time the gear has been extended by the CO_2 system, do not operate the gear or flap selector handles until the system has been repaired.

3.21 MANUAL EXTENSION OF WING FLAPS

To extend the wing flaps manually, place the flap selector control in the "DOWN" position. Pull the hand hydraulic pump handle fully aft and pump until the desired flap setting is obtained or until the flap selector control automatically returns to the neutral position.

3.23 ENGINE FIRE ON GROUND (Engine start, taxi and takeoff with sufficient distance remaining to stop)

The first step to extinguish the fire is to turn "OFF" the fuel selector and electric fuel pump. Brakes should be used as required. OPEN the throttle and use the radio to call for assistance.

If the fire continues, move the mixture control to IDLE CUT-OFF, shut down the engines and evacuate the airplane; the fire should be extinguished by external means.

If the fire is on the ground near the airplane, it may be possible to taxi to safety.

3.25 ENGINE FIRE IN FLIGHT

If an engine fire occurs in flight, place the mixture control of the involved engine in idle cut-off and turn "OFF" its electric fuel pump and fuel selector. Feather the propeller on the faulty engine. Increase power on the good engine, and reduce drag by ensuring that gear and wing flaps are retracted and cowl flaps on the feathered engine are closed. Turn "OFF" the alternator and magnetos of the feathered engine and reduce the electrical load on the remaining alternator. Complete the Engine Securing procedure and prepare for a landing at the nearest airport.

3.27 CABIN FIRE

In the event of a fire in the cabin, close all vents and turn the heater "OFF." Extinguish the fire with the fire extinguisher if it is installed. If a fire extinguisher is not available, use any means available to smother or douse the fire. When the fire is out, ventilate the cabin to clear smoke and fumes.

3.29 ELECTRICAL FIRE

The first step in coping with an electrical fire is to turn the master switch "OFF." During night flight, be sure a flashlight is in hand before turning "OFF" the master switch. Check for open circuit breakers; then pull all circuit breakers. Turn "OFF" all electrical switches, avionics switches, and the heater. Close all ventilators. If a fire extinguisher is available, apply it to the fire.

When the fire is out, turn the master switch "ON" and open the ventilators. Electrical switches and circuit breakers may be turned back "ON," one at a time, for the individual units required for flight. Faulty units should remain "OFF."

NOTE

The stall warning system will not function with the electrical system completely shut down or inoperative.

3.31 EMERGENCY DESCENT

If a situation such as loss of oxygen at high altitude occurs and an emergency descent is necessary, slowly retard the throttles to idle. Place the propeller controls forward, and establish a shallow dive at a speed of 175 KIAS (131 KIAS in rough air). Close the cowl flaps to maintain engine temperatures during the dive.

3.33 GOING INTO CROSSFEED

Crossfeed operation should be employed only when it is necessary to use fuel from the opposite side to extend range during single engine operation. To activate the crossfeed system, turn "ON" the fuel selector of the tank to be used on the inoperative engine side. Turn "ON" the electric fuel pump of the inoperative engine, and turn "ON" the crossfeed valve. Turn "OFF" the electric fuel pump of the operating engine, and turn "OFF" the fuel selector on the operating engine side. The electric fuel pump for the tank not in use on the operating engine side must be "OFF" to prevent the heating of trapped fuel and possible subsequent vapor lock upon coming out of crossfeed.

3.35 COMING OUT OF CROSSFEED

To return to normal operation during single engine flight when the crossfeed has been in use, first turn "ON" the fuel selector on the operating side. Turn "ON" the electric fuel pump of the operating engine, and turn "OFF" the electric fuel pump of the inoperative eingine. Turn the crossfeed "OFF." Then turn "OFF" the fuel selector on the inoperative engine side. When the electric fuel pump of the operating engine is no longer required to ensure fuel pressure, it may be turned "OFF."

3.37 ONE ALTERNATOR INOPERATIVE LIGHT ON

In the event of an alternator "INOP" indication, reduce the electrical load to the minimum necessary to sustain a safe flight. Turn "OFF" the side of the master switch corresponding to the side of the inoperative alternator. This will open the field circuit of the inoperative alternator. Reset any circuit breakers which have tripped. Return the master switch to the "ON" position, and, if the "INOP" light has extinguished, reinstate the electrical load. If the "INOP" light remains lit or if the alternator circuit breaker has tripped, return the corresponding side of the master switch to the "OFF" position and continue the flight with a reduced electrical load.

3.39 BOTH ALTERNATOR INOPERATIVE LIGHTS ON

If both alternator "INOP" lights come on simultaneously, repeat the above procedure individually for each alternator. Should both lights remain lit, turn "ON" both sides of the master switch, and turn "OFF" both alternator circuit breaker switches. Keep the electrical load reduced to a minimum and terminate the flight as soon as possible, since all electrical current is being supplied by the battery.

3.41 DOOR OPEN IN FLIGHT

If the cabin door is not securely safety latched with the handle pushed fully forward and locked and the auxiliary latch moved fully rearward to engage the latch pin before takeoff, the door could be inadvertently opened in flight. Should the door open in flight, immediately reduce airspeed to prevent serious buffeting, and land at the nearest airport.

3.43 SPIN RECOVERY

The FAA does not require spin demonstrations of airplanes of this weight; therefore, no spin tests have been conducted. The spin recovery technique is based on the best available information.

If a spin occurs, retard both throttle controls to idle. Apply full rudder opposite to the direction of the spin and place the control wheel forward of neutral, full forward if necessary to affect recovery. Leave ailerons neutral. Neutralize rudder when rotation stops. Smoothly recover from the dive when the spin is arrested.

3.45 AIRFRAME VIBRATION

In the event the airplane begins vibrating or handling characteristics become suddenly erratic without apparent reason, reduce airspeed until the vibration stops. Handle the controls smoothly and gently, avoiding sudden or abrupt maneuvers. Land at the nearest airport to investigate the cause of the vibration. Check that baggage and access doors are closed, that control surfaces are secure, and that no structural damage is present. Do not resume flight until the cause of the vibration is determined and corrected.

3.47 GEAR UP LANDING

In such situations as an emergency landing on water or extremely soft surfaces, or a complete landing gear failure, a gear up landing may be unavoidable. When a gear up landing is necessary, make a normal approach with power. Be sure seat belts and shoulder harnesses of all occupants are securely fastened.

Complete the normal landing check list except for the landing gear selector. The landing gear selector handle should be "UP." If time permits, feather the propellers and use the starters to rotate the propellers to a horizontal position. Close the throttles and turn "OFF" the master switch and the magneto switches. Turn "OFF" the fuel valves. Touch down at lowest possible airspeed.

3.49 EMERGENCY EXIT

In an emergency, the airplane may be vacated through the emergency exit window, the middle window on the left side of the airplane. The window should not be removed except in an emergency. To open the emergency exit, first remove the plastic handle guard and turn the handle. The window may then be pushed outward away from the fuselage by applying a steady, sustained pressure on the bottom sill.

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SECTION 4

NORMAL PROCEDURES

SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations for Aztec F airplanes with normally aspirated engines. All of the required (FAA regulations) procedures and those necessary for the safe operation of the airplane as determined by the operating and design features of the airplane are presented.

Normal procedures associated with those optional systems and equipment which require handbook supplements are presented in Section 9 (Supplements).

These procedures are provided as a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section is a short form check list which supplies an action sequence for normal procedures with little emphasis on the operation of the systems.

The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthly explanations. The short form check list should be used in flight.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the safe operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engines, airplane, and equipment, atmospheric conditions and piloting technique.

		CAS KNOTS	IAS KNOTS
(a)	Never Exceed Speed	216	221
(b)	Maximum Structural Cruising Speed	172	175
(c)	Design Maneuvering Speed	129	131
(d)	Flaps Extended Speed	60 to 108	55 to 108
	Full Flaps	108	108
	Half Flaps	122	123
	Quarter Flaps	139	141
(e)	Maximum Gear Extended Speed	130	132
(f)	Air Minimum Control Speed	70	64
(g)	Stall Speed		
	Gear Up, Flaps Up	67	61
	Gear Down, Flaps Down	60	55
(h)	Best Rate of Climb Airspeed	104	103
(i)	Best Angle of Climb Airspeed	91	89
(j)	Turbulent Air Operating Speed (5200 lbs)	129	131
(k)	Intentional One Engine Inoperative Speed	83	80

The maximum demonstrated crosswind velocity for safe takeoff and landing is 12 knots.

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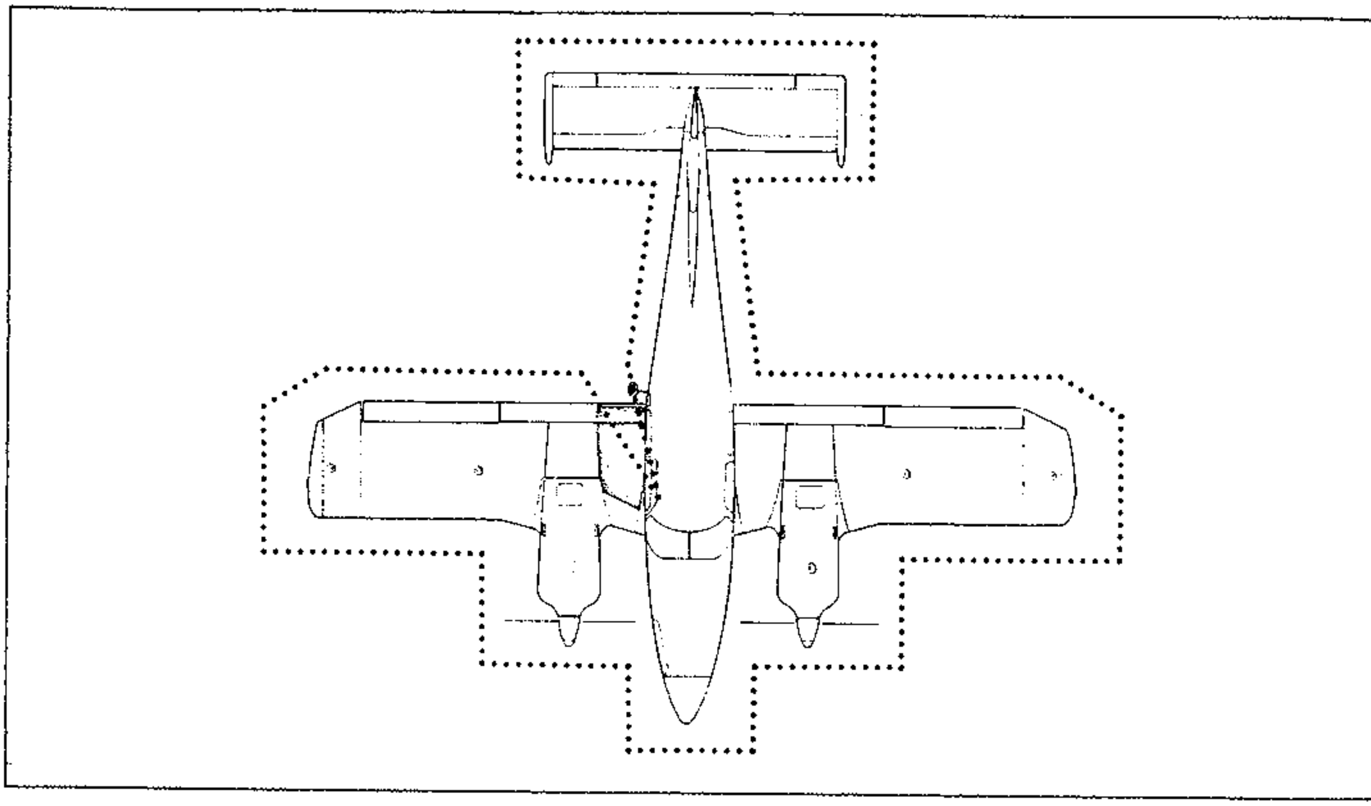

WALK - AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREPARATION

Airplane status . . . . airworthy, papers on board
Baggage . . . . weighed, stowed, tied
Weight and C.G. . . . . within envelope
Charts and navigational equipment . . . . on board
Mike and headset . . . . on board
Performance . . . . .computed and safe

PREFLIGHT INSPECTION

INSIDE CABIN

Avionic equipment . . . . .OFF
Fuel selectors . . . . both ON
Gear selector . . . . DOWN
Master switch . . . . .ON
Gear lights . . . . 3 green
Fuel quantity . . . . adequate
Elect. fuel pumps . . . . .check, then OFF
Cowl flaps . . . . OPEN
Alternator inop. lights . . . . .checked
Master switch . . . . .OFF
Wing flaps . . . . check by hand pump
Magneto switches . . . . .OFF
Mixtures . . . . idle cut-off
Trim . . . . neutral
Oxygen . . . . .OFF, quant. checked, masks on board
Controls . . . . .free and checked
Crossfeed . . . . drained
Emergency exit . . . . secure
Parking brakes . . . . set

OUTSIDE CABIN

Rear baggage door .... check
Fuselage and antennas .... check
Crossfeed drain .... no drip
Right wing, flap, aileron .... check
Right tie down .... untied
Fuel caps .... check quanity and secure
Right gear .... check chock removed
Right fuel drains .... drain 3
Right engine .... examine and check oil
Right propeller and spinner .... check
Windshield .... check
Nose gear .... check chock removed
Nose baggage door .... check
Nose .... check
Left wing .... check as right wing
Stall warning sensor .... check
Pitot tube and heater .... check, clean static ports
Empennage .... check condition and freedom of movement
Tail tie down .... untied
Night flight .... check lights

BEFORE STARTING ENGINES

Entrance door .... locked
Auxiliary latch .... engaged
Seats .... adjusted and locked
Seat belts and harnesses .... fastened

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Parking brake .... set
Circuit breakers .... check
Alternators .... ON
Electrical switches .... as required
Fuel pumps .... OFF
Fuel valves .... ON
Crossfeed .... OFF
Cowl flaps .... OPEN
Master switch .... ON
Gear lights .... check
Door ajar lights .... out
Mixture controls .... idle cut-off
Prop synch. .... MANUAL
AP/FD switch .... OFF
Gear handle (dual pump system .... DOWN

STARTING ENGINES

If engines are hot, omit priming
Throttle controls .... open one inch
Propeller controls .... forward
Electric fuel pumps .... ON
Mixture controls .... RICH until fuel flow ind., then OFF
Magneto switches .... ON
Propellers .... clear
Starter .... engage
Mixture .... advance as engine fires
Oil pressure .... check
Vacuum .... check
Alternator .... check output
Gear handle (dual pump system .... returned to neutral
Repeat above for second engine
Electric fuel pumps .... OFF

FLOODED START

Master switch .... ON
Magneto switches .... ON
Electric fuel pump .... OFF
Throttle .... full open
Mixture .... in idle cut-off
Starter .... engage
Throttle .... retard as engine starts
Mixture control .... advance
Oil pressure .... check
Vacuum .... check
Alternator .... check output

PRE-TAXI AND DURING TAXI

Lights .... as required
Radios .... checked
Autopilot .... ON, checked then disengaged
D/G and A/H .... set
Altimeter .... set and checked
Crossfeed .... check and OFF
Engine-driven hydraulic pump (single pump) .... check
Parking brake .... OFF
Brakes .... check
Flight instruments .... check while moving

ENGINE RUN-UP

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Parking brakes .... set
Cabin heater .... check
Engine temperature .... warm
Mixtures .... full RICH
Propellers .... full high rpm
Propellers synchrophaser .... manual
Engine gauges .... check
Throttles .... set at 1500 rpm
Feathering .... check (500 max. rpm drop)
Throttles .... set at 2000 rpm
Propeller controls .... exercise (300 max. rpm drop)
Magnetos .... check
(1) Max. drop - 175 rpm
(2) Diff. left to right - 50 rpm
Engine instruments .... check
Alternators .... check
Vacuum .... check
Throttles .... check idle, (500 rpm minimum) set 1000 rpm

BEFORE TAKEOFF

Seats and seat belts .... secure
Shoulder harnesses .... secure
Avionics .... checked and set
Fuel selector .... ON, crossfeed OFF
Engine gauges .... checked
Alternators .... ON and checked
Autopilot .... checked and OFF
Gyros, clock, altimeter .... set
Cowl flaps .... OPEN
Mixtures and propellers .... full forward
Quadrant friction .... set
Flight controls .... set
Trim .... set (pitch and yaw)
Wing flaps .... (check visually) set to 0
Door .... locked
Icing equipment .... checked - as required
Electric fuel pump .... ON

TAKEOFF

Brakes .... off
Throttles .... full forward
Power and airspeed .... check
Rotate .... at 64 KIAS min.
Landing gear .... retract
Accelerate to climb speed

CLIMB

Power .... set
Engine instruments .... monitor
Cowl flaps .... as required
Fuel pumps .... OFF
Best rate of climb airspeed .... approx. 100 KIAS at sea level

CRUISE

Power .... set
Cowl flaps .... as required
Mixture .... lean
Oxygen (above 10,000 ft.) .... ON (No Smoking)
Engine gauges .... monitor

DESCENT

Mixtures .... Enrich with descent
Power .... set
Defroster .... ON (if required)
Oxygen (below 10,000 ft.) .... OFF

BEFORE LANDING

Seat and seat belts .... secure
Shoulder harnesses .... secure
Fuel pumps .... ON
Mixtures .... RICH
Propellers .... 2400 rpm min.
Fuel selectors .... ON - fullest cells
Crossfeed .... OFF
Cowl flaps .... as required
Landing gear (130
KTS max.) .... DOWN and locked
Wing flaps .... set
Heater .... FAN
Brakes .... checked
Prop synch. .... OFF

GO-AROUND

Propellers .... full increase RPM
Throttles .... full forward
Wing flaps .... retract in steps
Landing gear .... retract
Cowl flaps .... set for cooling

AFTER LANDING

Brakes .... test
Flaps .... retract
Cowl flaps .... OPEN
Fuel pumps .... OFF
Propeller controls .... forward
Heater .... FAN
Trim .... neutral

SHUTDOWN

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Parking brake .... set
Heater .... OFF
Avionics .... OFF
Magnetos .... check grounding
Gear handle (dual
pump system .... DOWN,
then returned
to neutral
Mixture (2nd eng.) .... idle cut-off
Magnetos .... OFF
Lights .... OFF
Master switch .... OFF
Controls .... secure with seat belt

4.13 STARTING ENGINES

(a) Starting Engines When Cold

With the master switch "ON" and the electric fuel pump "ON," open the throttle control one inch and place the propeller control forward. Engines are primed by advancing the mixture control to the "RICH" position until fuel flow is indicated on the fuel flow meter, then pulling back to idle cut-off.

After ensuring that the propellers are clear, turn the magneto switches "ON," and engage the starter. As the engine fires, advance the mixture control. This procedure may then be repeated for the second engine.

If an engine does not fire within 5 to 10 seconds, disengage the starter and reprime.

(b) Starting Engines When Hot

If the engines are hot, the priming steps should be omitted. Fuel pumps should remain "OFF," and the mixture control should remain in idle cut-off until the engine fires.

(c) Starting Engines When Flooded

If an engine is flooded, the master switch and the magneto switches should be "ON," the electric fuel pump "OFF," the throttle fully open, and the mixture control in idle cut-off. When the starter is engaged and the engine fires, the throttle control should be retarded and the mixture control advanced.

When an engine is firing evenly, check the oil pressure gauge, the vacuum gauge, and the alternator output. The landing gear selector handle (dual pumps) should return to neutral. Turn the electric fuel pumps "OFF." If no oil pressure is indicated within 30 seconds (slightly longer in temperatures of 10° F or below) the engine should be stopped until the trouble is determined.

It is recommended that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starters.

4.15 PRE-TAXI AND DURING TAXI

Before taxiing, lights and radios may be turned on as required. If an autopilot is installed, it may be turned "ON" and checked and then turned "OFF." Gyro instruments and altimeters should be set. The engine-driven hydraulic pump (single pump system) can be checked by placing the gear selector in the "DOWN" position with the gear extended and the left engine running. If the hydraulic pump is functioning, the selector will return to the neutral position. The parking brake must be released before taxiing.

While taxiing, apply the brakes to ascertain their effectiveness. Making slight turns allows the rudder operation and the nose wheel steering to be checked. While the airplane is moving, check the operation of the flight instruments.

To ensure that the emergency locator transmitter has not been accidentally activated, a check should be made by tuning a radio receiver to 121.5 MHz. An oscillating sound indicates that the locator may have been activated.

Check the crossfeed occasionally after starting the first engine by following the procedures outlined in paragraph 4.39, section (c) (3) of this handbook.

It is best to apply power gradually to start the taxi roll. The pilot should observe wing clearance while taxiing and should avoid holes and ruts. If the ground contains loose stones, gravel, or other material that could damage propeller blades, do not operate engines at high RPM.

4.17 ENGINE RUN-UP

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

During the engine run-up, the parking brake should be set "ON." The cowl flaps should be manually opened as necessary for engine cooling during ground operations. The autopilot should be "OFF." In cold weather, or if flight into cold weather is anticipated, the cabin heater and defroster must be tested before takeoff, as an inoperative heating system may allow the windshield to become frosted. Operating the heater controls and feeling for warm air at the outlets will confirm heater and defroster operation.

Engines should be warmed up at 1000 to 1400 RPM for 2 minutes in warm weather and 4 minutes in cold. Engines are sufficiently warm for takeoff when no faltering occurs with the throttles fully open and when safe ranges are indicated on the engine gauges. To prevent spark plug fouling, avoid prolonged idling at low RPM.

Set the mixture controls at full "RICH" and the propeller controls at full high RPM. If the airplane is equipped with the propeller synchrophaser installation, place the switch in the "MAN" or off position. With the throttles set at 1500 RPM, check propeller feathering; however, during this check, engine speed must not be allowed to drop below 1000 RPM or else excessive manifold pressure will occur. With the throttles set at 2200 RPM, exercise the propeller controls slowly to check propeller governor operation, without allowing the engine speed to drop more than 300 RPM.

With the engine running at 2200 RPM and the propellers at maximum RPM, check the magnetos. The maximum drop on each magneto should not exceed 175 RPM, and the differential drop between the magnetos should not exceed 50 RPM. Operation on one magneto should be limited to 10 seconds.

After checking engine gauges and instruments, alternators, and the vacuum gauge for safe readings, throttles should be pulled to idle speed. Engine speed should not fall below 500 RPM; the recommended idle speed is between 550 and 600 RPM. After checking idle, set the throttles at 1000 RPM.

4.19 BEFORE TAKEOFF

After checking that all occupants have their seat belts and shoulder harnesses securely and properly fastened, the pilot should begin final preparations for takeoff. Lights, pitot heat, and radios should be set as required. The autopilot, if installed, should be checked and off. Fuel selectors may be on either the inboard or the outboard tanks provided there is adequate fuel in the tank selected, and the crossfeed must be "OFF."

Before takeoff, make a final check of the engine gauges. All indicators should read within the green arcs. Recheck the alternator output and the gyro vacuum gauge. Gyros and altimeters should be set, and the clock should be set and wound. Check that the cowl flaps are open. Mixture and propeller controls should be full forward. The slightly rich setting at takeoff power aids in engine cooling. To prevent creeping of the controls, the friction lock should be tightened. Flight controls should be operating properly. Stabilator and rudder trim tabs should be set for takeoff. Wing flaps should be set at 0° and visually checked. Be sure that the cabin door is securely closed, latched, and locked and that the auxiliary latch is engaged. To insure constant fuel flow during takeoff, turn "ON" both electric fuel pumps. Do not take off with ice or frost on the wings, as ice and frost will radically change the flight characteristics of the airplane. If icing conditions are anticipated during or soon after takeoff, icing equipment should be checked and on. Boots should not be operated during takeoff or landing.

4.21 TAKEOFF

Advance the throttles to approximately 15 inches MAP prior to brake release, then advance fully forward. Position the control wheel near neutral. Monitor power and airspeed, and direction. If the airplane is properly trimmed, a light back pressure on the control wheel will allow the airplane to lift from the runway. On takeoff, the airplane should be kept on the runway surface until Vmc (64 KIAS) is reached. After Vmc is reached, the airplane should be accelerated as rapidly as possible to the best climb speed. During normal conditions, landing gear should be retracted when a gear down landing on the runway is no longer possible.

4.23 CLIMB

If there are no obstacles to be cleared, after reaching Vmc accelerate as quickly as possible to the best rate of climb speed. If there are obstacles to be cleared, maintain the best angle of climb speed. The applicable speed should be maintained until all obstacles are cleared and the airplane attains an altitude of at least 400 feet above ground level. During climb, monitor engine instruments and adjust cowl flaps as required to maintain cylinder head temperatures below 500°F.

When the airplane reaches an altitude of 500 feet above ground level, the electric fuel pumps should be turned "OFF," one at a time. As each pump is turned "OFF" check the fuel flow to ensure that the engine-driven fuel pumps are operating. Climb at the best rate of climb airspeed to the desired altitude.

4.25 CRUISE

During cruise, power settings should be made in accordance with the information given in Section 5 (Performance). To INCREASE power first enrich mixture, then increase RPM; then increase manifold pressure. To DECREASE power, first decrease manifold pressure; then decrease RPM; then lean mixture as allowable.

Cowl flaps should be positioned as required to maintain allowable cylinder head and oil temperatures.

During climbs, the servo regulator of the fuel injection system senses changes in altitude and automatically leans the mixture. For complete approved leaning procedures refer to the appropriate Lycoming Operator's Manual and the latest issue of Lycoming Service Instruction 1094. To improve economy, the mixture may be leaned manually with the mixture control. Detailed information on cruise settings and cruise performance is presented in Section 5 (Performance) and in the applicable Lycoming engine manual.

Since a fuel injected engine takes an appreciable length of time to start after fuel starvation, fuel cells should not be emptied to depletion. If it is necessary to use all the fuel in a cell, carefully monitor the fuel flow meter, and change the fuel selector valve position at the first indication of a decrease in fuel flow.

At altitudes above 10,000 feet, the use of oxygen is recommended. When oxygen is in use no smoking is permitted.

4.27 DESCENT

With power set as desired, begin descent, enriching the mixture as the altitude decreases. Turning the defroster "ON" will preclude the possibility of sudden windshield fogging during descent. If oxygen has been in use, it may be turned "OFF" at altitudes below 10,000 feet.

4.29 BEFORE LANDING

When preparing to land the airplane, ensure that seats are locked in position and that seat belts and shoulder harnesses are securely fastened. Prior to landing, the electric fuel pumps should be "ON," fuel selectors should be on the fullest cells, and the crossfeed must be "OFF." Set the mixture control at full "RICH," and the propellers at a minimum of 2400 RPM. Cowl flaps should be used as required.

Before extending the landing gear, a check may be made to ensure that the gear warning horn is operating. Retard both throttles until the horn sounds. Flying the airplane with an inoperative horn is not permitted, since in an emergency landing, a single engine landing or any other situation when there is a distraction from landing procedures, inadvertently forgetting to extend the gear is a possibility.

At an indicated airspeed of 132 knots or less, landing gear should be extended and locked. To ascertain that the gear is down and locked on the base leg or final approach, check the three green gear down indicator lights on the control pedestal and check the external mirror to ensure that the nose gear is extended.

Depending on landing conditions, the wing flap setting varies. Following are the maximum airspeeds at which wing flaps may be set:

(a) 1/4 flap - 141 KIAS
(b) 1/2 flap - 123 KIAS
(c) Full flap - 108 KIAS

The degree of wing flap extension and touch down speed depends upon landing conditions. Normally full flap (50 degrees) should be used during the final approach and landing to reduce stall speed and to permit contact with the runway at slower speed. For short, slow landings under normal conditions, use full wing flaps, partial power, and hold the nose up as long as possible before and after contacting the ground with the main wheels.

In high winds and crosswinds, it is desirable to approach a landing at higher than normal speeds with half or completely retracted wing flaps. During a crosswind approach, hold a crabbed angle into the wind until ready to flare out for the landing. Then lower the wing that is into the wind, reduce crabbed angle, and use rudder to keep the wheels aligned to the runway.

During landings, contact the ground at the minimum speed consistent with landing conditions.

Avoid prolonged side slips with a fuel selector set on a fuel cell with a low fuel indication.

If the heater has been in operation, turn the heater control switch to "FAN" to allow the unit time to cool down. If a propeller synchrophaser is installed, place the switch in the "MAN" or off position.

Prior to landing and early in the roll out, check the operation of the brakes.

4.31 GO-AROUND

If a go-around is necessary, place the propeller controls in full increase RPM and the throttle controls full forward. Retract the wing flaps in steps and retract the landing gear. Adjust the cowl flaps as necessary for engine cooling.

4.33 AFTER LANDING

After touching down on the runway, maximum braking may be achieved by retracting wing flaps and pulling back on the control wheel as brakes are applied. If there is no need for maximum braking, the safest practice is to retract the flaps after the airplane has been maneuvered off the runway. It is possible that a pilot would inadvertently reach for the landing gear selector instead of the wing flap control while there is still enough lift on the wings to keep the full weight of the airplane off the wheels and thus prevent the actuation of the landing gear safety mechanism and allow the gear to retract during the ground roll. In the event a landing must be made without wheel brakes, the airplane should be flown to contact the ground at the slowest possible speed and landed short on the longest available runway.

When the landing is completed and while taxiing, the toe brakes may be tested. Spongy brake pedal action is often an indication that brake fluid needs replenished. Retract the wing flaps and open the cowl flaps. Turn electric fuel pumps "OFF." Place the propeller controls full forward.

If the heater has been in operation, check that the heater control switch is in the "FAN" position. The heater should never be turned "OFF" unless it has had time to cool down. Trim tabs should be set to neutral.

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

When completely stopped and in a parking spot, set the parking brake. If the heater has been used and has been allowed to cool down, turn it "OFF." Turn "OFF" radio and electric equipment.

Check the magnetos by turning each "OFF" then "ON." An RPM drop when a magneto is "OFF" indicates that the magneto and its switch are operative. On aircraft with dual hydraulic pumps, the engine that was started first should be shut down first. Move its mixture control to idle shut-off. After the first engine is shut down, check the function of the hydraulic pump on the still operating engine by moving the landing gear selector handle to the "DOWN" position. If the pump is functioning properly the handle will return to neutral. After this check is complete, shut down the second engine by placing its mixture control in idle cut-off. When the engines stop, turn magnetos, the master switch and light switches "OFF."

Depending upon the length of time the airplane is to be left unattended, moor it appropriately.

4.37 TURBULENT AIR OPERATION

In keeping with good operating practice for all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed or slightly less and that abrupt maneuvers be avoided.

4.39 SYSTEMS OPERATIONS AND CHECKS

(a) Alternator and Voltage Regulating System

Each alternator is controlled by its own voltage regulator. These regulators are interconnected electronically to provide paralleled outputs from their associated alternators under normal operating engine RPM ranges. An ammeter then can be switched into either alternator output lead is provided for system monitoring, along with alternator "INOP" warning lights that illuminate when their associated alternator is not producing a voltage.

In the event of an alternator "INOP" indication, the following steps should be taken:

(1) Reduce the electrical load to the minimum necessary for continued safe flight.
(2) Turn "OFF" one section of the master switch (left or right, as appropriate) to open the corresponding alternator field circuit. Reset all circuit breakers which may have tripped.
(3) Turn "ON" the section of the master switch which had been turned "OFF" in step (2) above, and if the "INOP" light goes out, reinstate the electrical load.
(4) If, after turning the section of the master switch back "ON", the "INOP" light remains lit and/or the alternator circuit breaker switch has tripped, turn the same section of the master switch "OFF" and continue flight with a reduced electrical load.
(5) In the event that both "INOP" lights come on simultaneously, repeat the above procedure for each alternator individually.
(6) If both alternators fail to return to normal operation, turn "ON" the master switch and turn "OFF" both alternator circuit breaker switches. Terminate flight as soon as possible.

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for the safe operation of the airplane.

NOTE

This airplane is certified as a normal category airplane and must be operated in compliance with the FAA Approved Pilot's Operating Handbook. Acrobatic maneuvers (including spins) are prohibited. Maintain at least 5000 feet of terrain clearance when practicing stalls.

Avoid abrupt maneuvers. Maneuvers at speeds and weights in excess of the maneuvering speeds and loadings listed in Section 2 (Limitations), may subject the airplane to load factors beyond those for which it is certified.

4.9 PREFLIGHT CHECK

The airplane should be given a thorough preflight and walk-around check. The preflight should include a determination of the airplane's operational status, a check that necessary papers and charts are on board and in order, and a computation of weight and C.G. limits, takeoff distance and in-flight performance. Baggage should be weighed, stowed and tied down. Passengers should be briefed on the use of seat belts and shoulder harnesses, the emergency exit, oxygen, and ventilation controls, advised when smoking is prohibited, and cautioned against handling or interfering with controls, equipment, door handles, etc. A weather briefing for the intended flight path should be obtained, and any other factors relating to a safe flight should be checked before takeoff.

Upon entering the cockpit, release the seat belt securing the control wheel. After insuring that avoinics equipment is "OFF", both fuel selectors are "ON" and the landing gear selector handle is in the "DOWN" position, the master switch should be turned "ON." The three green gear down lights should illuminate. Check that the alternator "INOP" lights are on. Place the fuel selector in each tank position to check the fuel gauges. Drain the crossfeed and check the operation of the electric fuel pumps; then turn the electric fuel pumps "OFF." After completing these checks, turn the master switch "OFF." Open the cowl flaps. The operation of wing flaps may be checked with the emergency hydraulic hand pump. Before leaving the cockpit for the walk-around, check that magnetos are "OFF," the mixture control is in idle cut-off, and trim controls are set to neutral. Check that the emergency exit is secure and ensure that the parking brake is set "ON."

During the walk-around inspection, the security of the rear baggage door should be checked first. Proceeding rearward and around the airplane, check the wings, control surfaces, and hinges for external damage and operational interference. The wings and all control surfaces should be free of ice, snow, frost, or other foreign materials. Check the condition of the fuselage, windows, antennas, and cables. If the airplane has been moored, tie-down ropes and wheel chocks should be removed.

At the wings, fuel filler caps should be removed and the fuel supply and fuel color checked visually. Fuel caps should be tightly sealed and properly secured, and fuel cell vents should be free of obstructions.

In checking the landing gear, it should be ascertained that shock struts are properly inflated. Under a normal static load, 3 inches of piston should be exposed. Check the tires for cuts and wear and ensure proper inflation.

Fuel strainers and drains should be opened to drain moisture and sediment. Three drains in the access door on the underside of each nacelle should be opened and drained until ensured that all moisture and sediment is removed. Check to make sure that the crossfeed drain is protruding from the underside of the fuselage. If the crossfeed has been drained, visually check that fuel is not dripping from the drain.

CAUTION

In checking fuel tanks and draining fuel, care should be taken that no fire hazard exists before starting engines.

Through the access doors on the top of each engine nacelle, check the quantity and the condition of the oil. The dipstick/oil filler cap should be firmly seated. Openings and air intakes in the nacelles should be free of obstructions. Check propellers and spinners for detrimental nicks, scratches, or other damage. There should be no obvious fuel or oil leaks.

If a pitot cover has been installed, it should be removed before flight, and the holes in the pitot-static head checked for bugs, dirt, or other obstructions.

At the front of the airplane, the forward baggage door should be secure. The windshield should be clean and free from damage or distortion. All access and inspection covers should be securely in place.

When the pitot heat, stall warning sensor, or exterior lights are to be checked, the master switch must be turned "ON."

Upon re-entering the cabin, ascertain that all primary flight controls work properly. The cabin door should be closed and secured with both latches, and the seats should be adjusted for maximum visibility and comfort. All required papers should be in order and in the airplane. Seat belts and shoulder harnesses should be fastened, and the function of the inertia reels checked by pulling sharply on the strap.

4.11 BEFORE STARTING ENGINES

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Before starting the engines, set the parking brake "ON" and open the cowl flaps. Circuit breakers should be checked and alternator circuit breaker switches should be turned "ON." Fuel selector levers should be set on the desired tanks; and the crossfeed should be turned "OFF." The electric fuel pumps should be off, and all other electrical switches set as required.

On aircraft equipped with two engine-driven hydraulic pumps, one installed on each engine, one pump should be checked during engine start and the other during engine shutdown. Move the landing gear selector handle to the "DOWN" position. If the hydraulic pump on the first engine to be started is functioning properly, the selector handle will return to neutral after the engine has started and pressure has built up in the system.

Aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed are equipped with one hydrualic pump on the left engine. A check of its pump can be performed during pre-taxi and taxi.

CAUTION

The alternator circuit breaker switches should not be opened manually when the alternators are functioning normally.

NOTE

If an external auxiliary power unit is used for starting, the master switch and all avionics switches should be turned OFF until both engines are running. Reduce engine power to idle before removing the external power unit. Turn ON the master switch and needed avionics switches after the external power unit has been disconnected. Short term use of external power with the master switch ON and all avionic switches OFF is permissible if the aircraft battery power is required to augment the external power source for starting engines.

(b) Circuit Breakers

All circuit breakers are grouped in the lower right corner of the instrument panel. To reset a circuit breaker, push in on the reset button.

(c) Fuel Management

(1) Normal Operation Takeoff and Landing
  a. Main fuel valves - "ON" (inboard or outboard)
  b. Electric fuel pumps - "ON"
  c. Crossfeed valve - "OFF"
(2) Normal Operation Cruising
  a. Main fuel valves - "ON" (inboard or outboard)
  b. Electric fuel pumps - "OFF"

(d) Strobe Anti-Collision Lights

The white wing tip anti-collision strobe lights are controlled by an on-off switch located in the lower left control panel.

WARNING

Turn "OFF" strobe lights when taxiing in the vicinity of other aircraft or during flight through cloud, fog, or haze. Standard position lights are to be "ON" for all night operations.

(e) Landing Gear Down Lights

The three green lights on the throttle quadrant indicate when each of the landing gear is down and locked.

(f) Alternate Induction Air

When flying in wet, heavy snow or other conditions in which the induction air filters may become clogged, monitor the manifold pressure gauge. A decrease in manifold pressure may indicate a clogged filter. If the decrease is followed by a slight increase in manifold pressure, the automatic alternate induction air system is in operation, and the manifold pressure may be brought back to the desired level with the throttle control.

A continued drop in manifold pressure would indicate that the automatic induction air system were not working. In this case, actuate the manual alternate air control, which serves as a backup for the automatic system. An increase in manifold pressure indicates that the manual alternate induction air system is operating. Throttle controls may be advanced to gain additional manifold pressure.

4.41 V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

V_{SSE} is a speed selected by the aircraft manufacturer as a training aid for pilots in the handling of multi-engine aircraft. It is the minimum speed for intentionally rendering one engine inoperative in flight. This minimum speed provides the margin the manufacturer recommends for use when intentionally performing engine inoperative maneuvers during training in the particular airplane.

The intentional one engine inoperative speed, V_{SSE}, for the PA-23-250F is 80 KIAS.

4.43 V_{MCA} - AIR MINIMUM CONTROL SPEED

V_{MCA} is the minimum flight speed at which a twin-engine airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank toward the operative engine; landing gear up; flaps in takeoff position; and most rearward center of gravity.

V_{MCA} for the PA-23-250 F has been determined to be 64 KIAS.

The V_{MCA} demonstration which may be required for the FAA flight test for the multi-engine rating approaches an uncontrolled flight condition with power reduced on one engine. The demonstration and all intentional one engine operations should not be performed at an altitude of less than 5000 feet above the ground. The recommended procedure for V_{MCA} demonstration is to reduce the power to idle on the simulated inoperative engine at or above the intentional one engine inoperative speed, V_{SSE}, and slow down to approximately one knot per second until the FAA Required Demonstration Speed, V_{MCA}, or stall warning is obtained.

V_{SSE} is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

V_{SSE} for the PA-23-250 F is 80 KIAS.

V_{MCA} DEMONSTRATION

(a)	Landing Gear	UP
(b)	Flaps	UP
(c)	Airspeed	at or above 80 KIAS (V_{SSE})
(d)	Propeller Controls	HIGH RPM
(e)	Thottle (Simulated Inoperative Engine)	IDLE
(f)	Throttle (Other Engine)	MAX ALLOWABLE
(g)	Airspeed	reduce approximately 1 knot per second until either V_{MCA} or STALL WARNING is obtained

CAUTIONS

Use rudder to maintain directional control (heading and ailerons to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either V_{MCA} or stall warning (which may be evidenced by: Inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn) immediately initiate recovery; reduce power to idle on the operative engine, and immediately lower the nose to regain V_{SSE}.

One engine inoperative stalls are not recommended.

Under no circumstances should an attempt be made to fly at a speed below V_{MCA} with only one engine operating.

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SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to the Aztec F is provided in this section.

The performance information presented in this section applies to both the normally aspirated and the optional turbocharged Aztec F models, and any performance variations between these two models will be notated.

5.3 INTRODUCTION TO PERFORMANCE AND FLIGHT PLANNING

The performance information in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the airplane. This performance can, however, be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts, such as the effect of a soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance, must be evaluated by the pilot. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided in item 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

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5.5 FLIGHT PLANNING EXAMPLE

The following Flight Planning Example illustrates the correct utilization of pertinent data presented in this section of the manual.

(a) Associated Conditions

Certain basic information must be gathered when planning a flight. This information includes departure and destination airport conditions, en route conditions, and basic aircraft conditions. Such factors as weather, the status of the runway, the distance of the flight, the number of passengers, etc., must be determined. Assume, for example, the following conditions:

(1) Departure Airport Conditions

Outside Air Temperature	17°C
Pressure Altitude	2000 ft.
Wind and Direction	15 kts at 360°
Runway Slope	+1.0%
Runway Direction	300°

(2) Cruise Conditions

Outside Air Temperature	-5°C
Pressure Altitude	10,000 ft.
En route Distance	500 naut. mi.
Power Setting	2400 RPM at 30 in. Hg.
Mixture Setting	Best Economy

(3) Destination Airport Conditions

Outside Air Temperature	20°C
Pressure Altitude	2000 ft.
Wind and Direction	10 kts at 330°
Runway Slope	+1.0%
Runway Direction	270°

(4) Aircraft Configuration

Basic Weight	3445 lbs.
Fuel Tanks (total)	144 gal.
Engines	Lyc. TIO-540-C1A
Occupants	4 at 170 lbs. each
Baggage	120 lbs.

(b) Aircraft Loading

The airplane weight and center of gravity may be determined by utilizing the information given in Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as delivered from the factory has been entered in Figure 6-7. If any alterations to the airplane affecting weight and balance have been made, reference to the aircraft logbook and Weight and Balance Record (Figure 6-9) should be made to determine the current basic empty weight of the airplane.

Use the Weight and Balance Loading Chart (Figure 6-15) and the Weight, Moment and C.G. Limit graph (Figure 6-17) to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, assume that the following weights have been determined for consideration in the Flight Planning Example:

(1)	Basic Weight	3445 lbs.
(2)	Occupants (4 at 170 lbs. each)	680 lbs.
(3)	Baggage	120 lbs.
(4)	Fuel (137.2 gal. at 6 lbs/gal)	823 lbs.
(5)	Takeoff Weight (total of above)	5068 lbs.
(6)	Landing Weight (takeoff weight minus Item (h), Total Fuel Required)	4548.4 lbs.

The landing weight cannot be determined until the weight of the fuel to be used has been established.

Takeoff weight is below the approved maximum of 5200 lbs. Determine that weight and balance calculations have shown the C.G. position to be within the approved limits.

(c) Takeoff Distance

After determining the aircraft loading, all aspects of takeoff must be considered. Conditions of the departure airport and takeoff weight should be applied to the appropriate Takeoff Distance graph to determine the length of runway necessary. Takeoff conditions for the Flight Planning Example are listed below:

(1)	Wind	15 kts at 360°
(2)	Angle between Flight Path and Wind	360°-300° = 60°
(3)	Head Wind Component (from Wind Component Graph, Figure 5-7)	8 kts
(4)	Outside Air Temperature	17°C
(5)	Pressure Altitude	2000 ft.
(6)	Runway Slope	+1.0%

Using the Normal Takeoff over 50 Feet graph for the Lyc. TIO-540-C1A engine (Figure 5-11) the takeoff distances are as follows:

Total Distance	2040 ft.
Ground Run (2040 x .6)	1225 ft.

(d) Climb

Entering the example conditions of the departure airport and the cruise altitude into the Time, Fuel and Distance to Climb graph for the Lyc. TIO-540-C1A engines (Figure 5-27) yields the following:

(1)	Time to Climb	6.8 - 1.3 =	5.5 minutes
(2)	Fuel to Climb	5.6 - 1.1 =	4.5 gallons
(3)	Distance to Climb	12.5 - 2.0 =	10.5 naut. miles

NOTE

The effect of winds aloft must be considered by the pilot when computing climb, cruise, and descent performance.

(e) Descent

Entering the cruise and destination airport conditions into the Time, Distance and Fuel to Descend graph (Figure 5-87) yields the following:

(1)	Time to Descend	10 - 2	= 8 minutes
(2)	Distance to Descend	22.5 - 4.5	= 18 naut. miles
(3)	Fuel to Descend	2.7 - 0.5	= 2.2 gallons

(f) Cruise

Subtracting the previously calculated distance to climb and distance to descend figures from the total en route distance yields the total cruise distance. For example:

Cruise Distance = En route Distance - Climb Distance - Descent Distance
= 500 - 10.5 - 18.0
= 471.5 naut. miles

From the Cruise Performance Tables (Figure 5-63) for Intermediate Cruise (2400 RPM at 30 in. Hg.), Best Economy Mixture, the cruise airspeeds are 179 kts. at 5200 lbs. and 182 kts. at 4800 lbs. Extrapolating these values for 5068 lbs. (preliminary cruise weight), the cruise speed is 180 kts.

From the same table, Fuel Flow is 29.3 gallons/hour.

Cruise time and fuel may be calculated by the following formula:

Cruise Time = Cruise Distance/Cruise Speed
= 471.5/180
= 2.619 hours or 157.2 minutes

Cruise Fuel = Fuel Flow x Cruise Time
= 29.3 x 2.619
= 76.7 gallons

The above data can be used to calculate an average cruise weight in the following manner:

$$\text{Average Cruise Weight} = \text{Takeoff Weight} - 6 \times \left(\text{Taxi Fuel} + \text{Climb Fuel} + \frac{\text{Cruise Fuel}}{2}\right)$$

$$= 5068 - 6 \times \left(4.0 + 4.5 + \frac{76.7}{2}\right)$$

$$= 4782 \text{ lb.}$$

From the Cruise Performance Table (Figure 5-63), the cruise speed is now 182 kts. for 4782 lbs. Applying the above cruise time and cruise fuel formula results in the following figures:

Cruise Time = 471.5/182
= 2.591 hours or 155.4 minutes

Cruise Fuel = 29.3 x 2.591
= 75.9 gallons

(g) Total Flight Time

The total flight time is determined by adding the time to climb, cruise time, and time to descend. The following flight time is required for this Flight Planning Example:

Total Flight Time = Time to Climb + Cruise Time + Time to Descend
= 7.5 + 155.4 + 8.0
= 170.9 minutes

(h) Total Fuel Required

Determine the total fuel required by adding fuel for taxi and takeoff, fuel to climb, cruise fuel, and fuel to descend. When the total fuel (in gallons) is determined, multiplying this value by 6 lbs/gal will give the total fuel weight to be used for the flight. Total fuel calculations for the Flight Planning Example are shown below:

Total Fuel Required = Fuel for taxi and takeoff + Fuel to Climb + Cruise Fuel + Fuel to Descend
= 4.0 + 4.5 + 75.9 + 2.2
= 86.6 gallons (519.6 lbs.)

(i) Landing Distance

Subtracting the total fuel required from the takeoff weight of the airplane gives the landing weight:

Landing Weight = Takeoff Weight - 6 x Total Fuel Required
= 5068 - 6 x 86.6
= 4548.4 lbs.

Destination airport conditions applied to the Wind Component graph (Figure 5-7) gives the following headwind component for the Flight Planning Example:

The angle between the flight path and wind is 330° - 270° or 60°.
Therefore, the Head Wind Component is 5 kts.

From the Normal Landing Distance over 50 Feet graph (Figure 5-93), with the destination airport conditions, the distances required for landing for the Flight Plan Example are as follows:

(1) Total Distance 1430 ft.
(2) Ground Roll 1430 X .6 = 860 ft.

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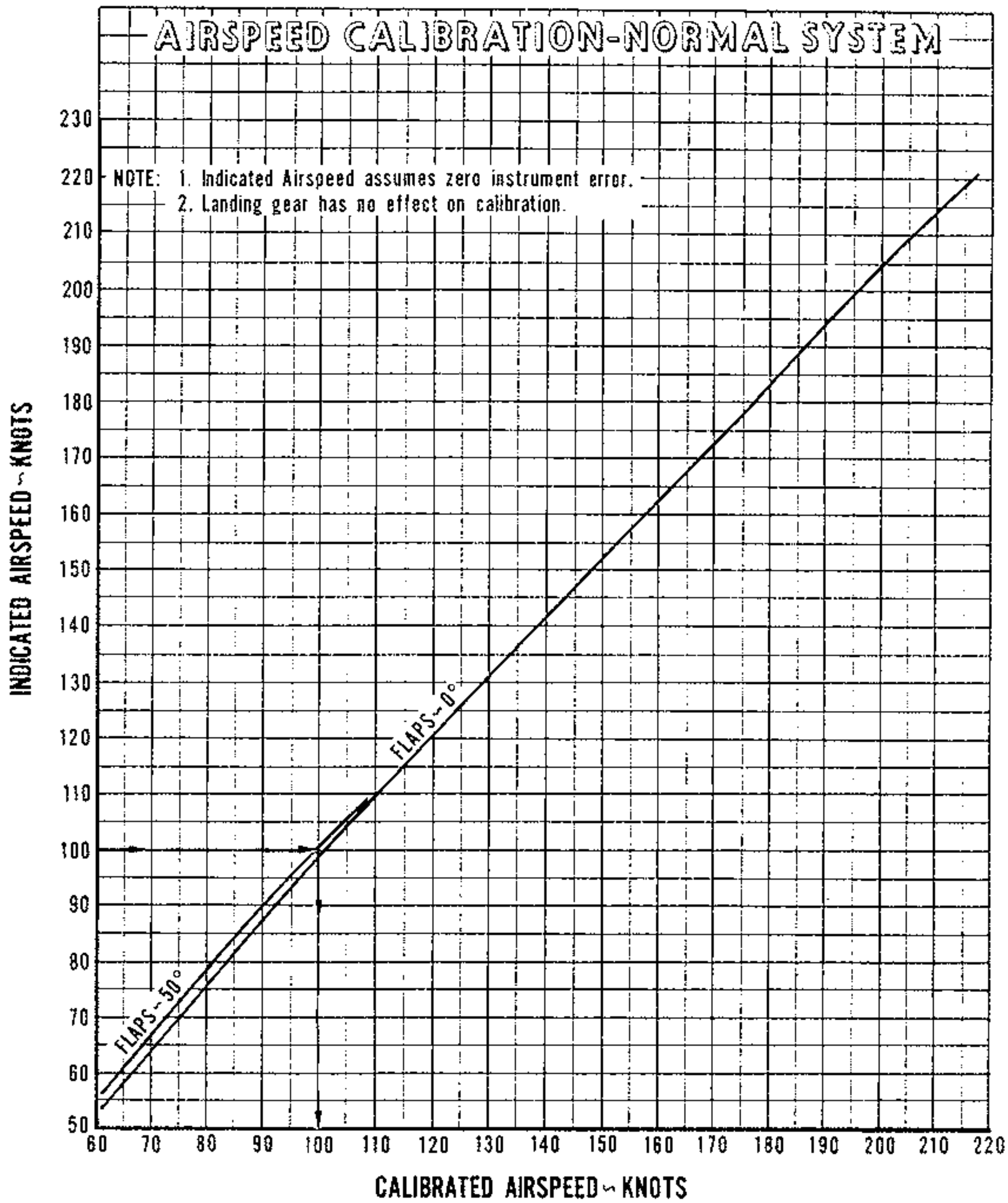
5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

LIST OF FIGURES (cont)

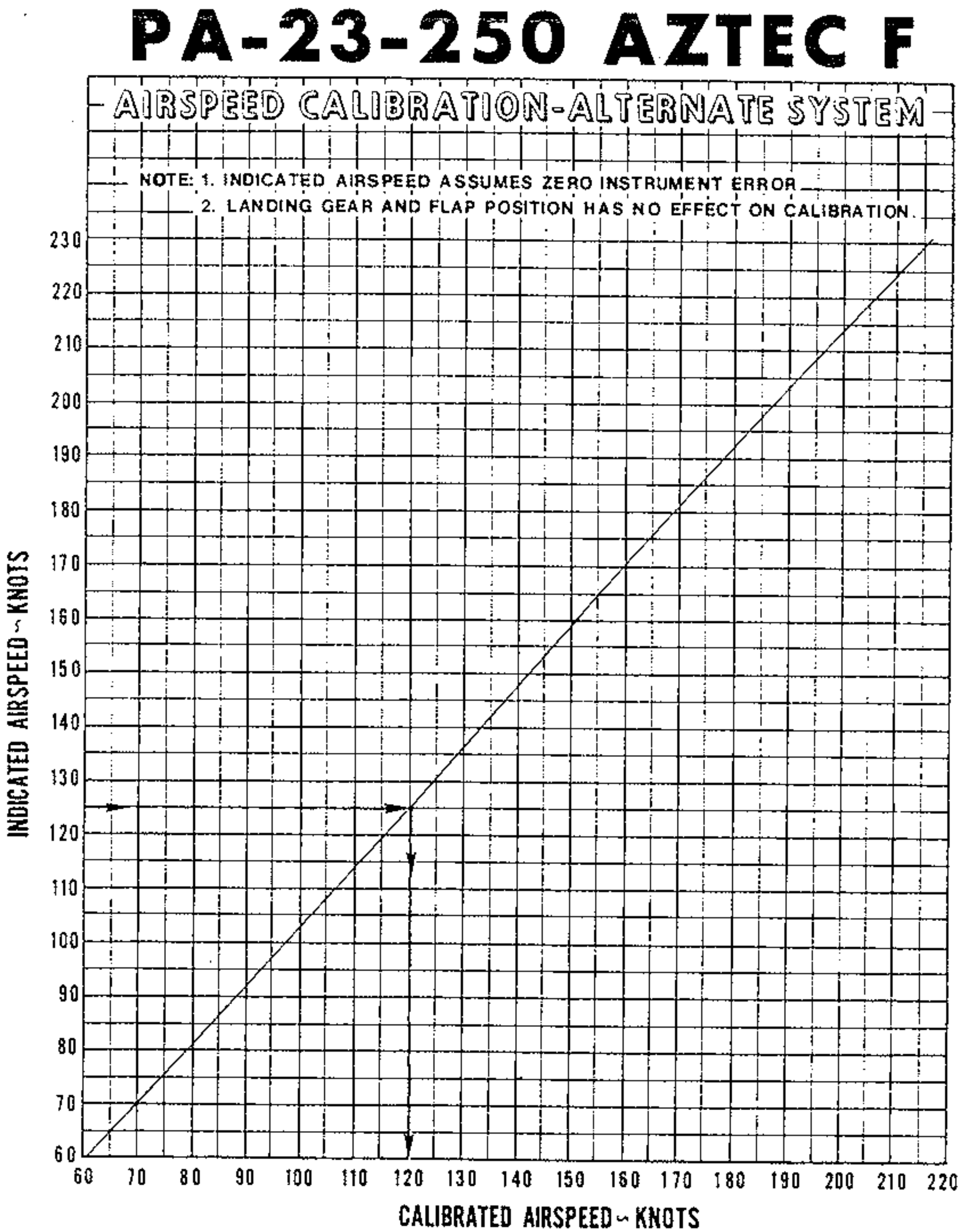
PA-23-250 AZTEC F



Example:
Indicated airspeed = 100 kts.
Flaps = 50°
Calibrated airspeed = 100 kts.

AIRSPEED CALIBRATION - NORMAL SYSTEM

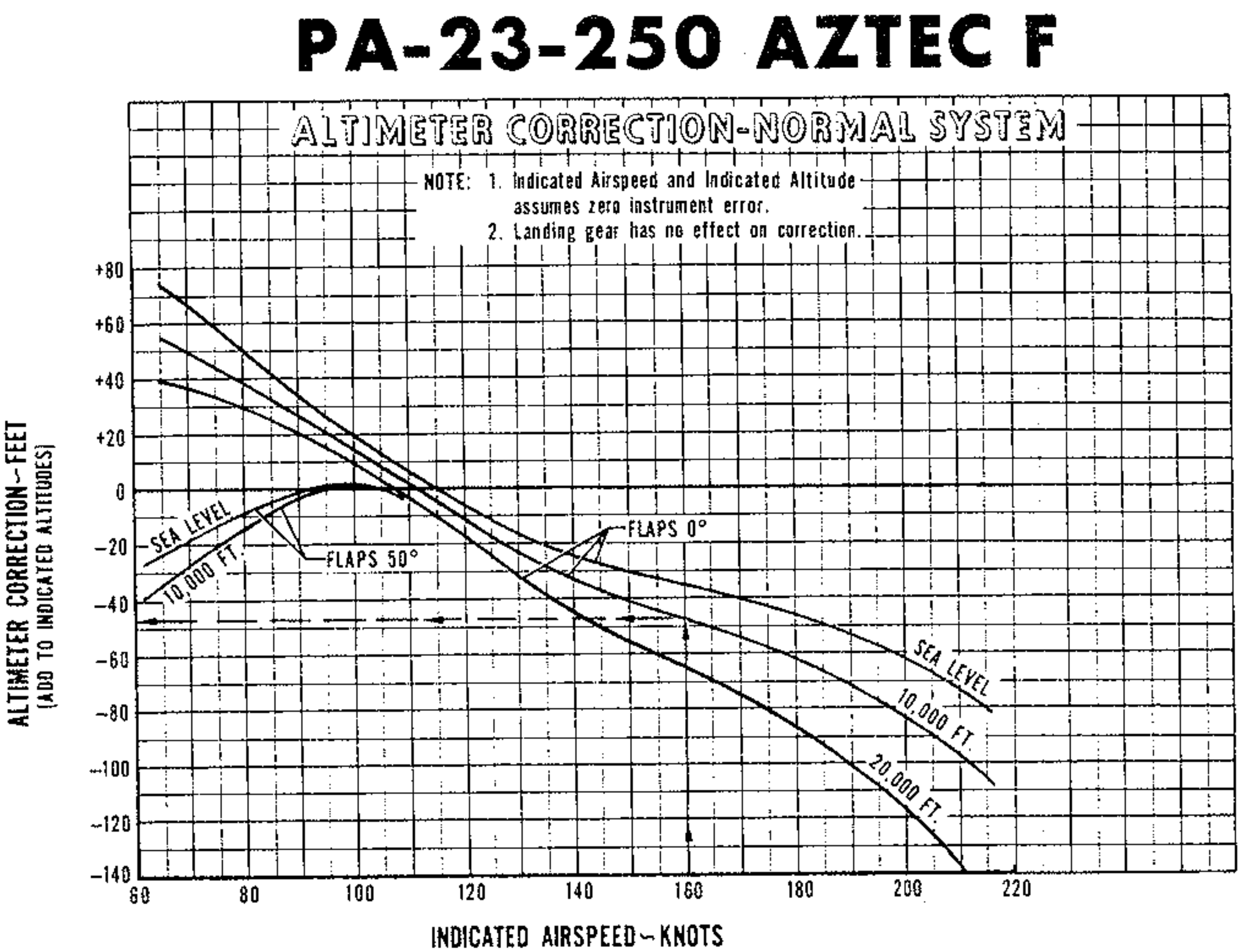
Figure 5-1



Example:
Indicated airspeed = 125 kts.
Calibrated airspeed = 120 kts.

AIRSPEED CALIBRATION - ALTERNATE SYSTEM

Figure 5-2

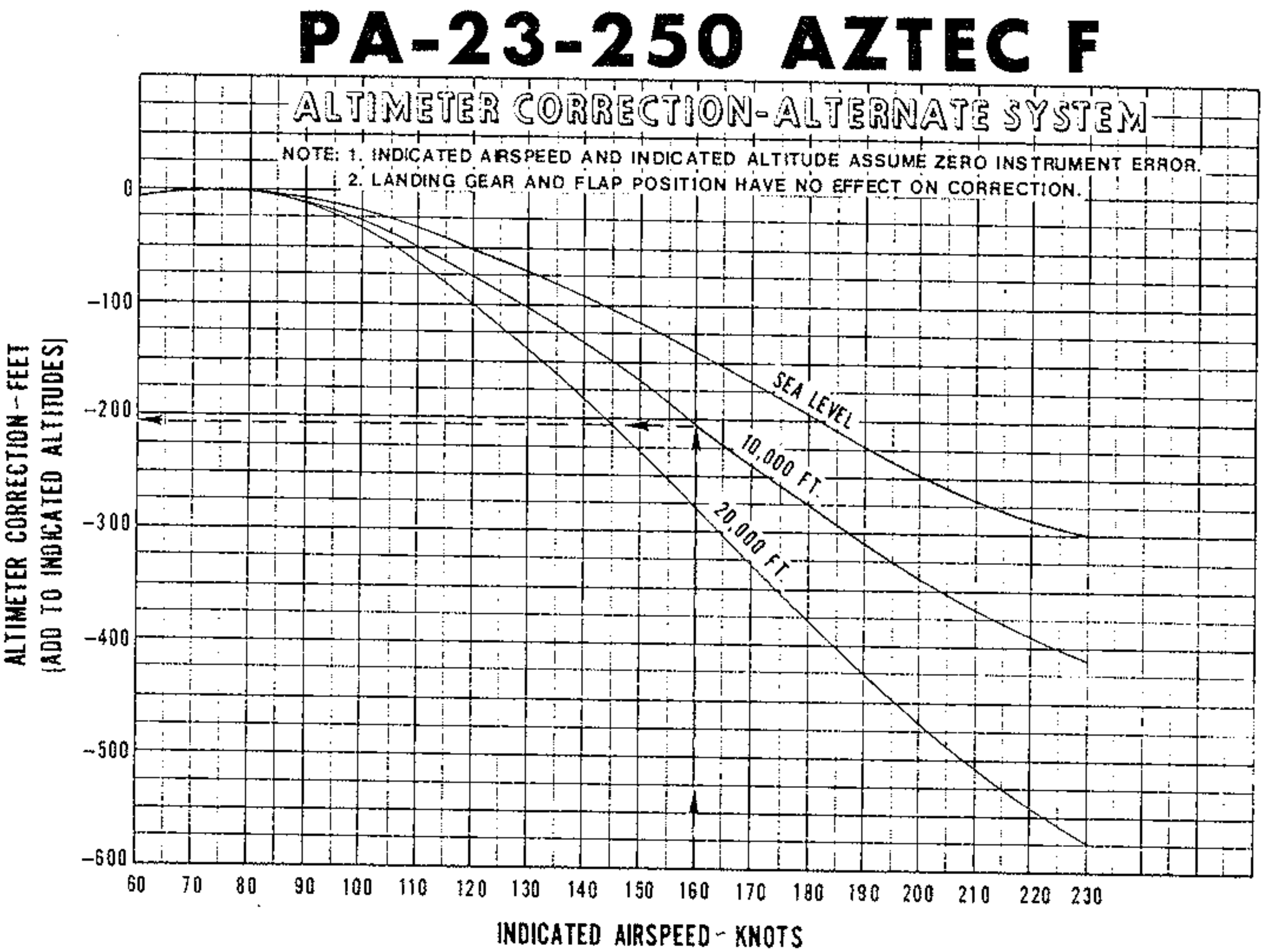


Example:

IAS	=	160 kts.
Altitude	=	10,000 ft.
Altimeter correction	=	-47 ft.
Calibrated altitude	=	9953 ft.

ALTIMETER CORRECTION - NORMAL SYSTEM

Figure 5-3

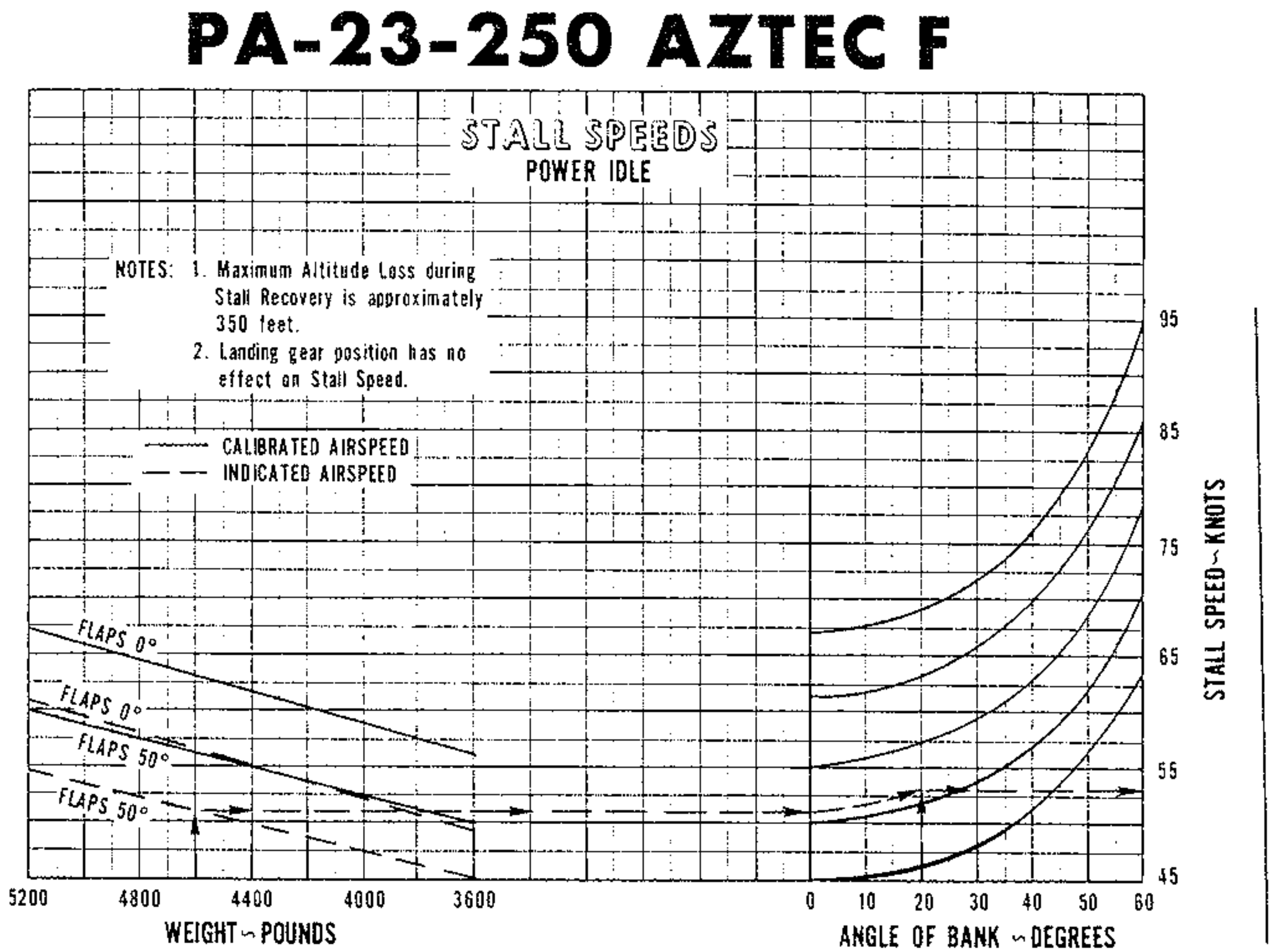


Example:

IAS	=	160 kts.
Altitude	=	10,000 ft.
Altimeter correction	=	-205 ft.
Calibrated altitude	=	9,795 ft.

ALTIMETER CORRECTION - ALTERNATE SYSTEM

Figure 5-4



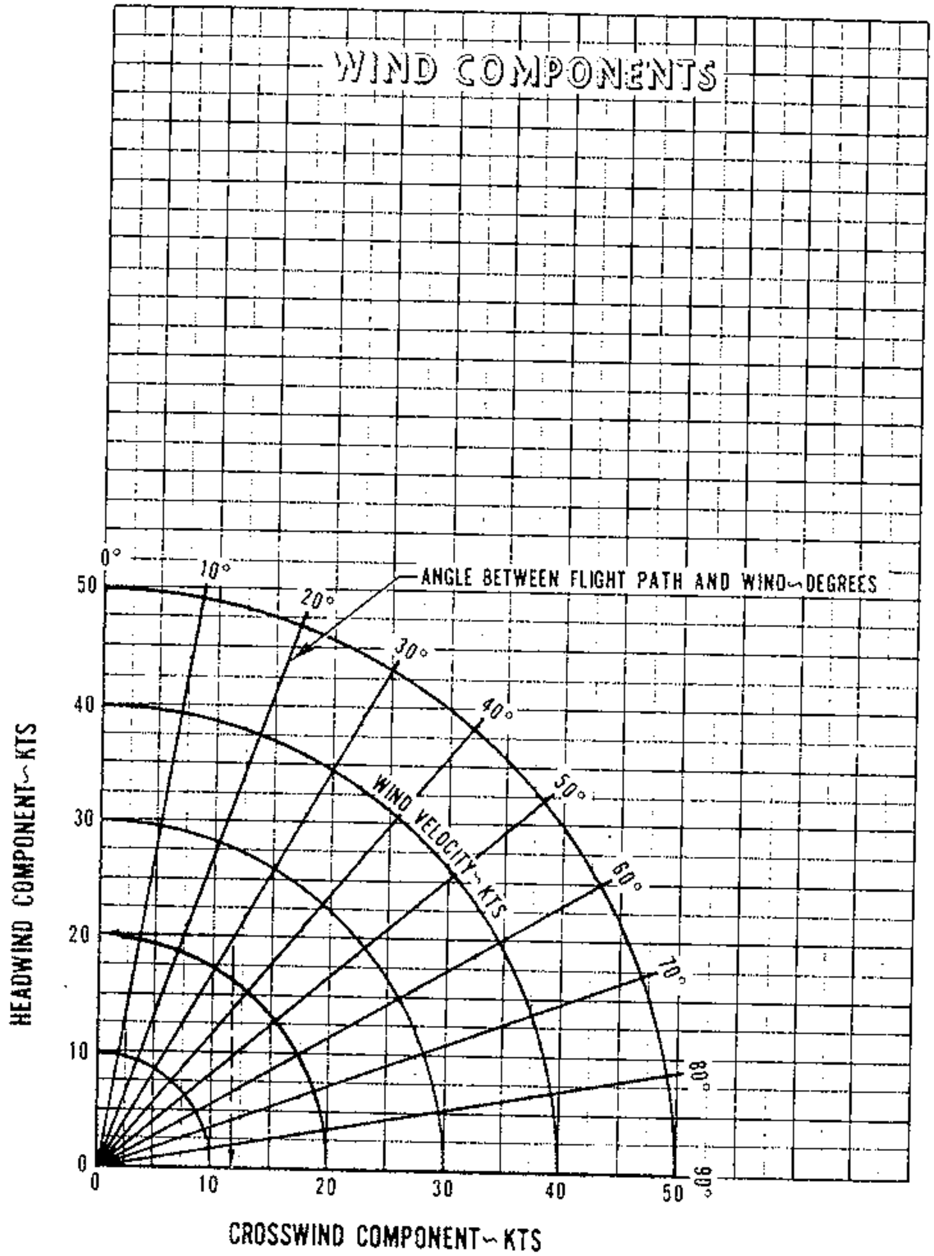
Example:

Weight	= 4600 lbs.
Flaps	= 50°
Angle of bank	= 20°
Stall speed	= 53 KIAS

STALL SPEEDS

Figure 5-5

PA-23-250 AZTEC F

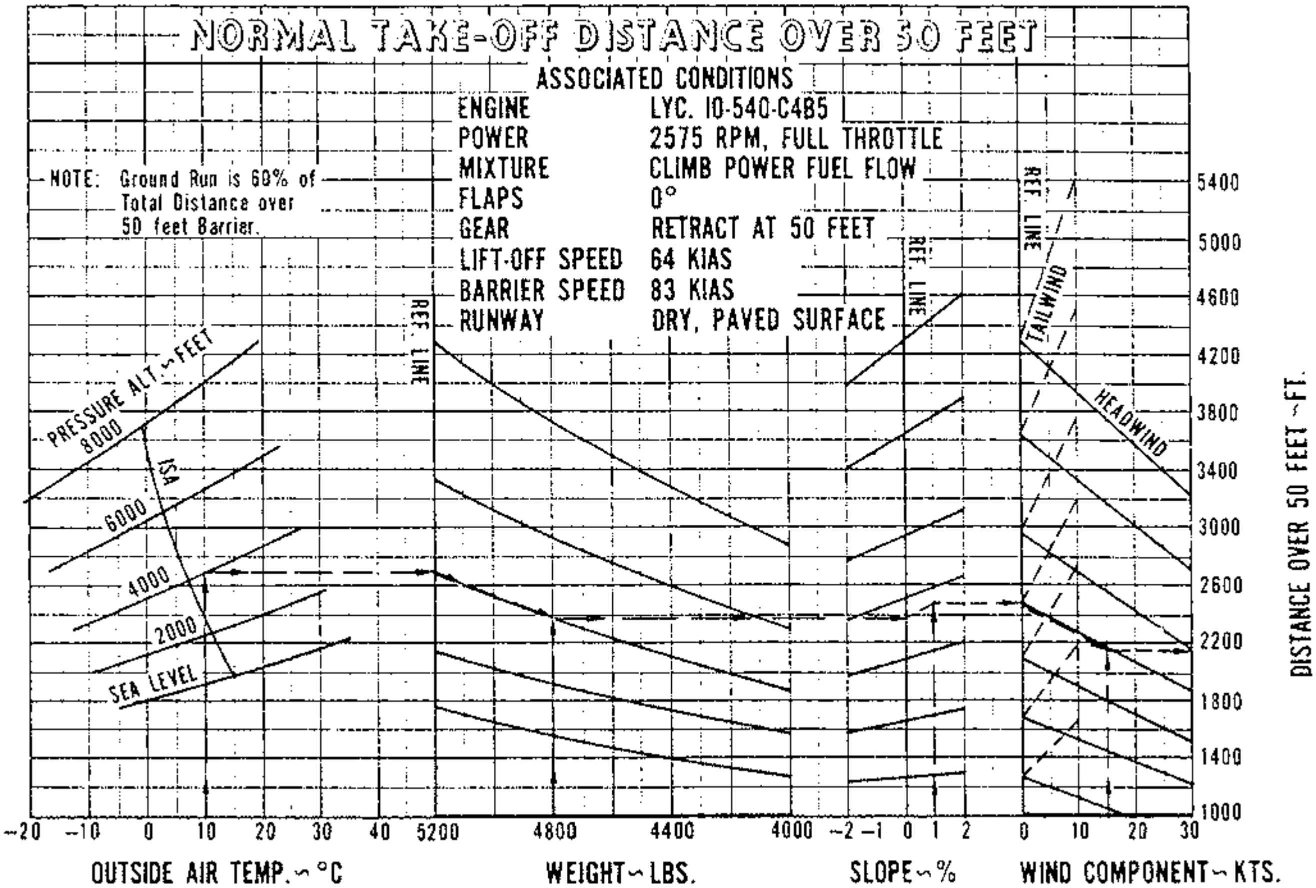


Example:

Wind Velocity	=	23 kts.
Angle between flight path and wind	=	30°
Headwind component	=	20 kts.
Crosswind component	=	12 kts.

WIND COMPONENTS
Figure 5-7

PA-23-250 AZTEC F



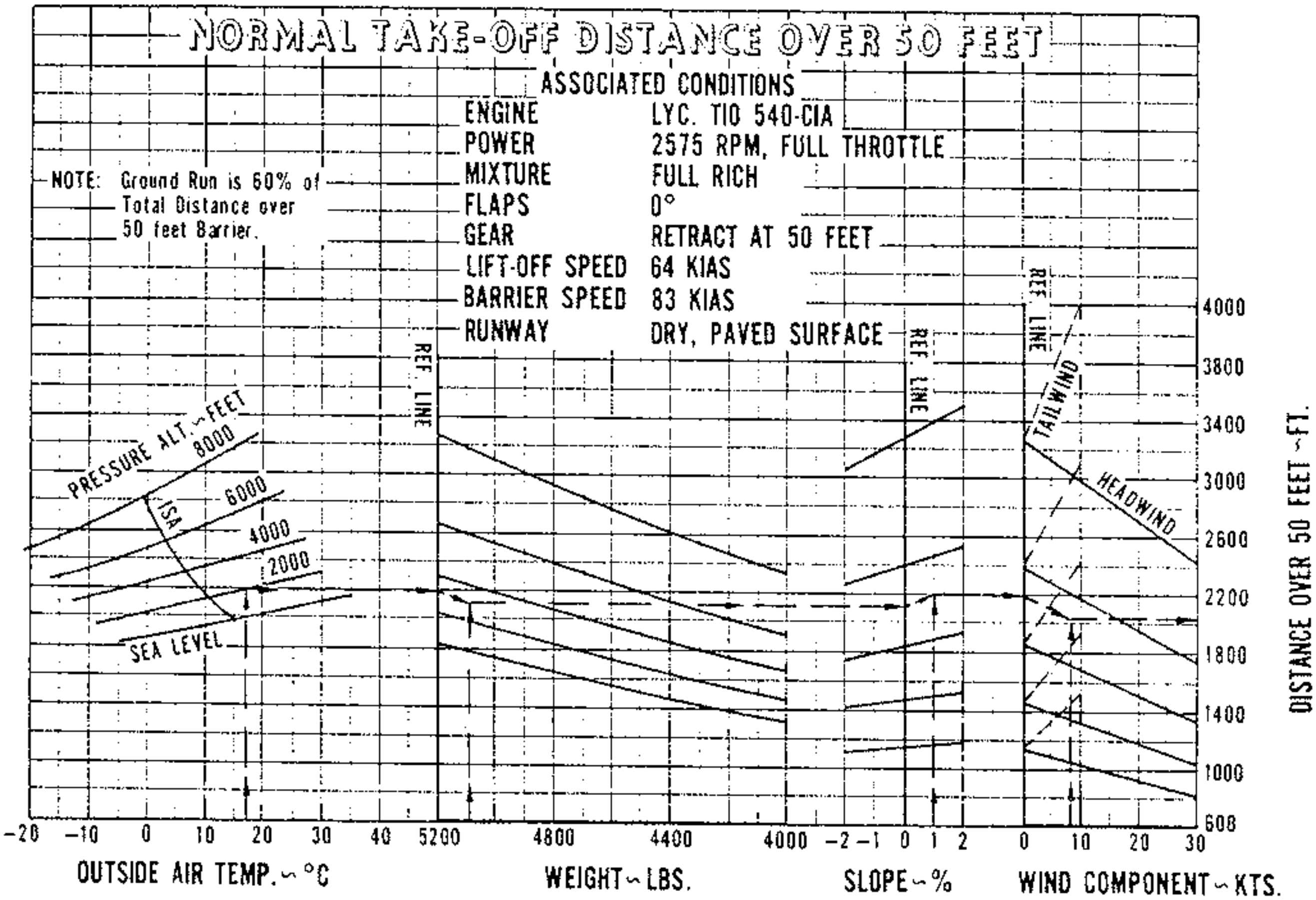
Example:

OAT	=	10° C
Pressure altitude	=	4000 ft.
Slope	=	+1.0%
Weight	=	4800 lbs.
Wind	=	15 kts.
Total distance	=	2140 ft.
Ground run	=	1180 ft.

NORMAL TAKEOFF DISTANCE OVER 50 FEET

Figure 5-9

PA-23-250 AZTEC F



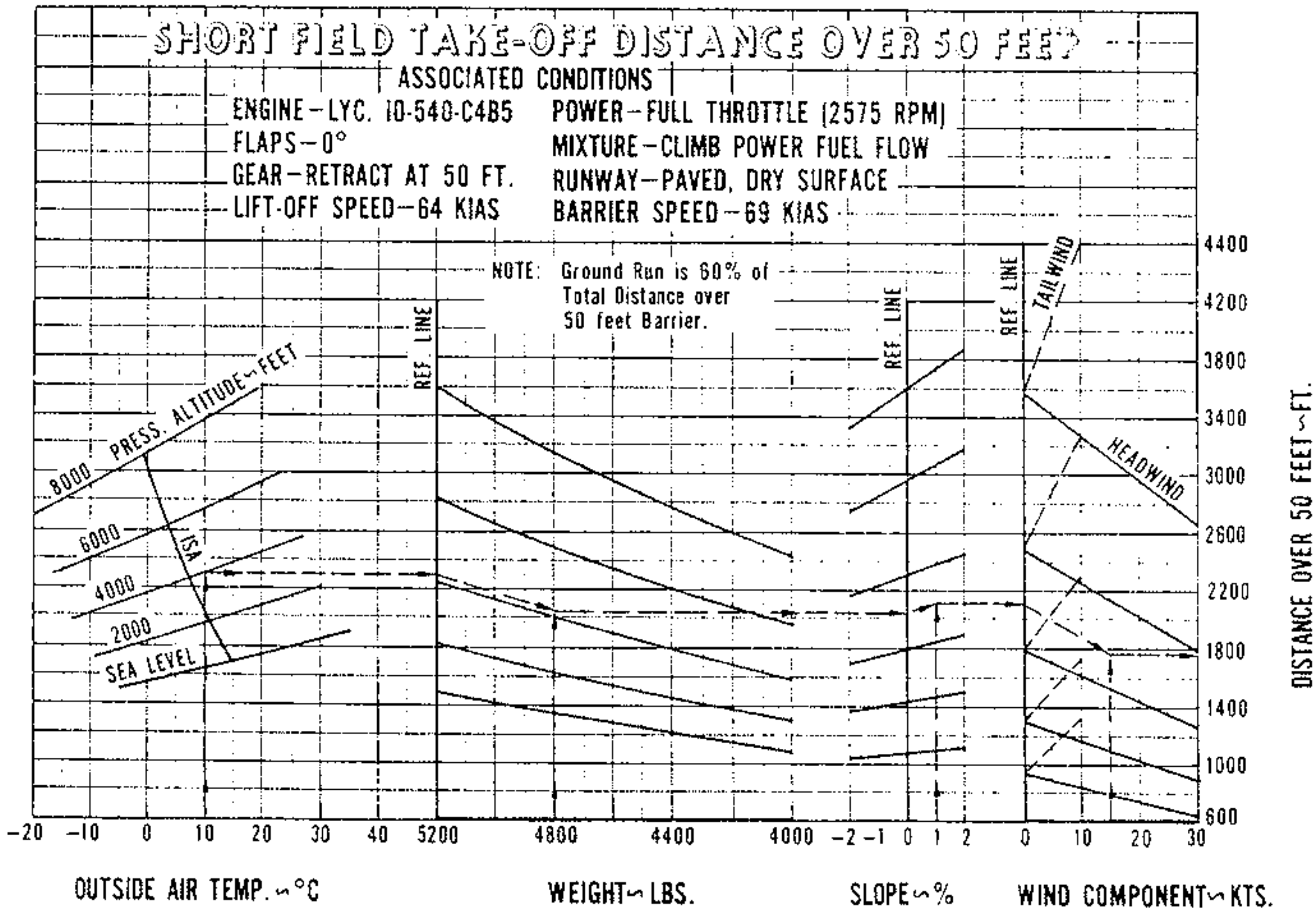
Example:

OAT	=	17° C
Pressure altitude	=	2000 ft.
Slope	=	+1.0%
Weight	=	5070 lbs.
Wind	=	8 kts.
Total distance	=	2040 ft.
Ground run	=	1225 ft.

NORMAL TAKEOFF DISTANCE OVER 50 FEET (TURBO)

Figure 5-11

PA-23-250 AZTEC F

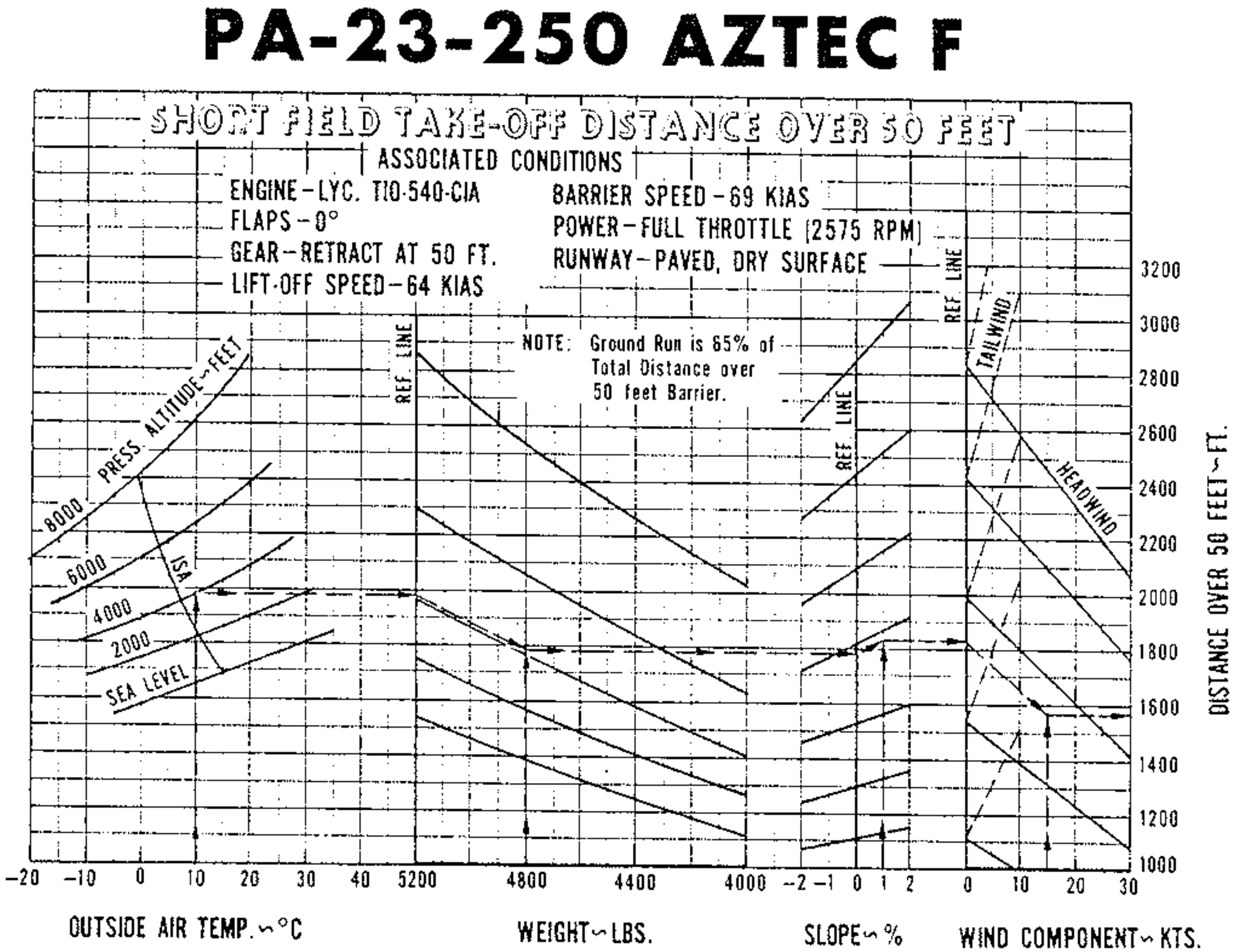


Example:

OAT	=	10° C
Pressure altitude	=	4000 ft.
Slope	=	+1.0%
Weight	=	4800 lbs.
Wind	=	15 kts.
Total distance	=	1760 ft.
Ground run	=	1060 ft.

SHORT FIELD TAKEOFF DISTANCE OVER 50 FEET

Figure 5-13



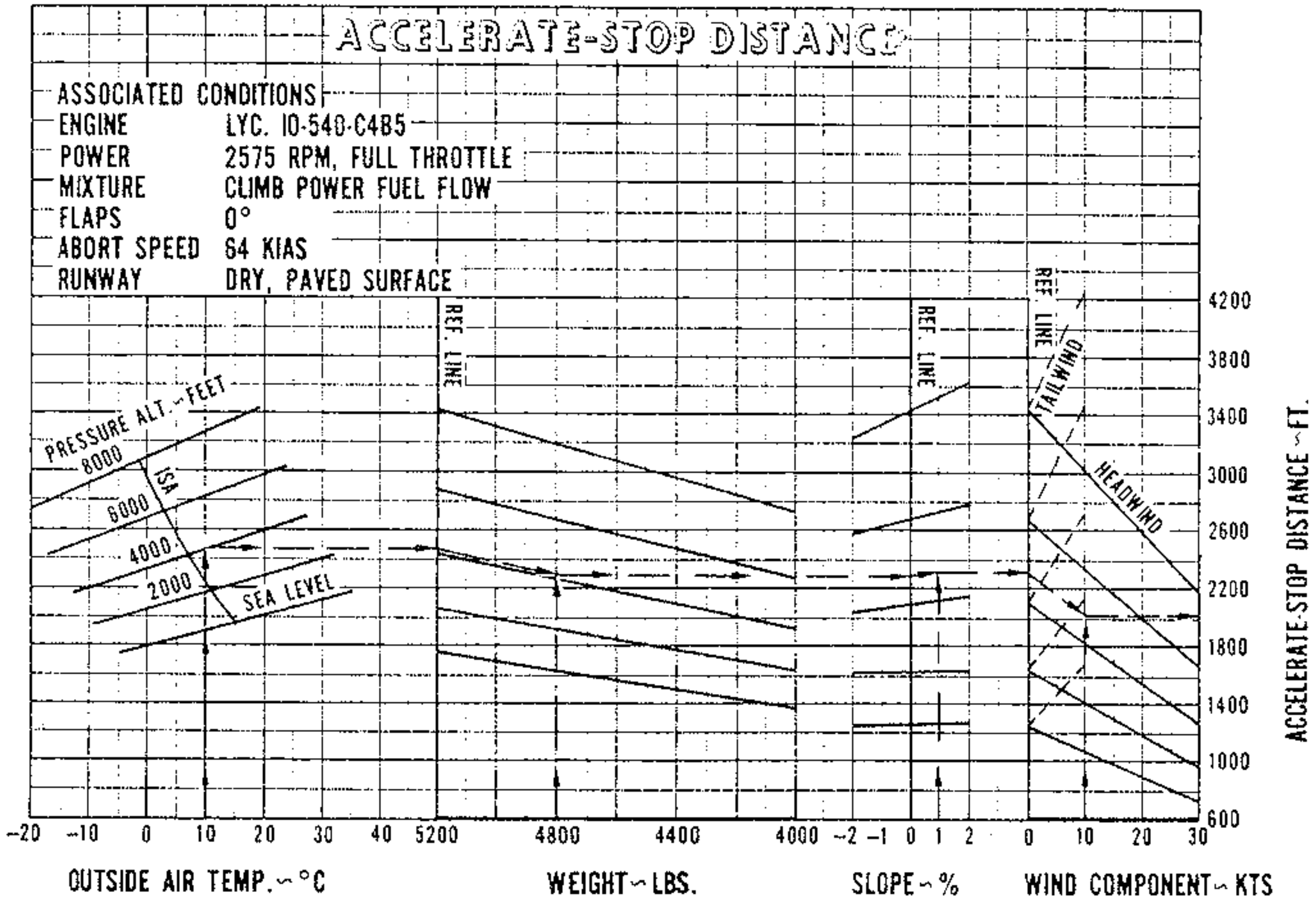
Example:

OAT	=	10° C
Pressure altitude	=	4000 ft.
Slope	=	+1.0%
Weight	=	4800 lbs.
Wind	=	15 kts.
Total distance	=	1570 ft.
Ground run	=	1020 ft.

SHORT FIELD TAKEOFF DISTANCE OVER 50 FEET (TURBO)

Figure 5-15

PA-23-250 AZTEC F

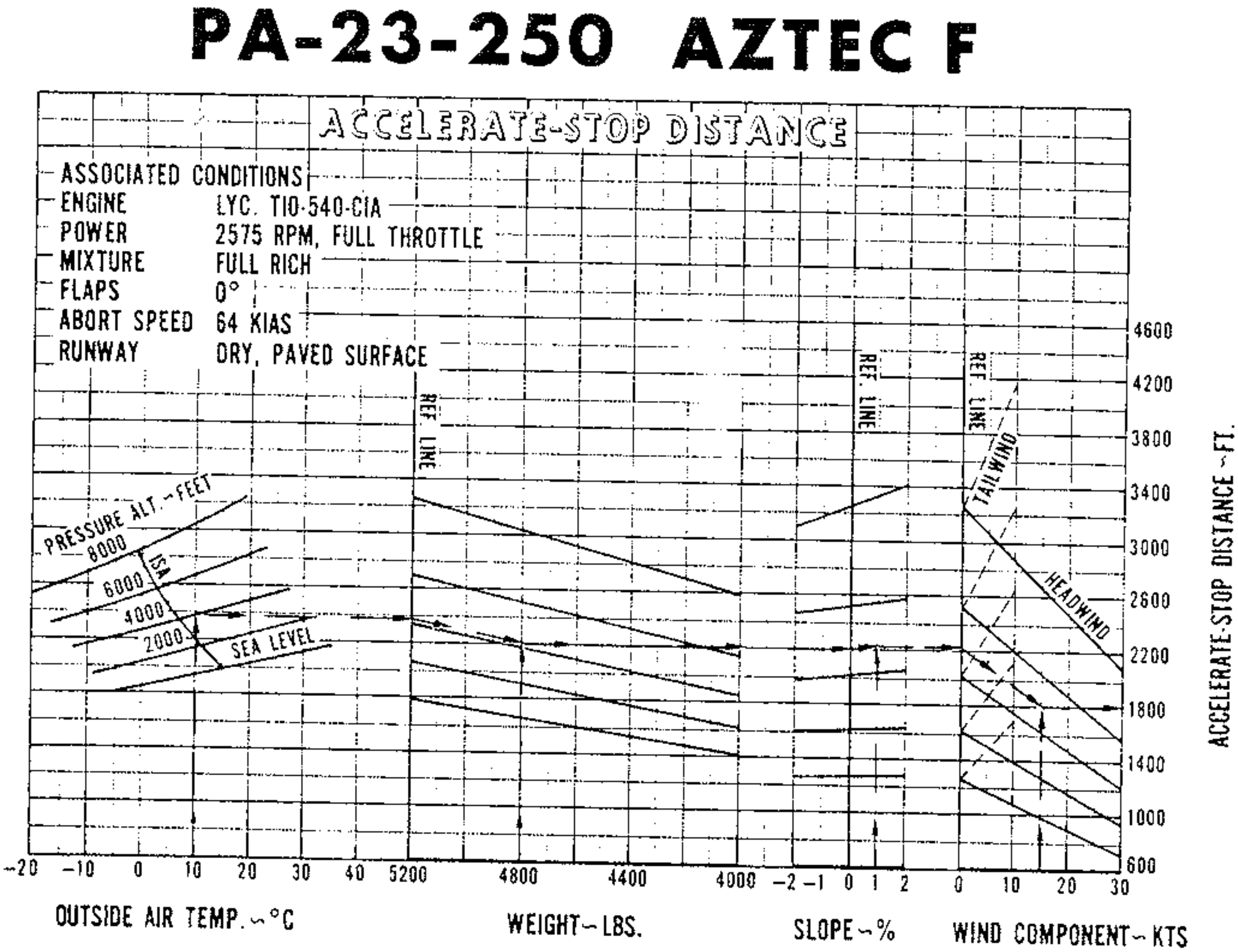


Example:

OAT	= 10° C
Pressure altitude	= 4000 ft.
Slope	= +1.0%
Weight	= 4800 lbs.
Wind	= 10 kts.
Accelerate - stop distance	= 2020 ft.

ACCELERATE - STOP DISTANCE

Figure 5-17

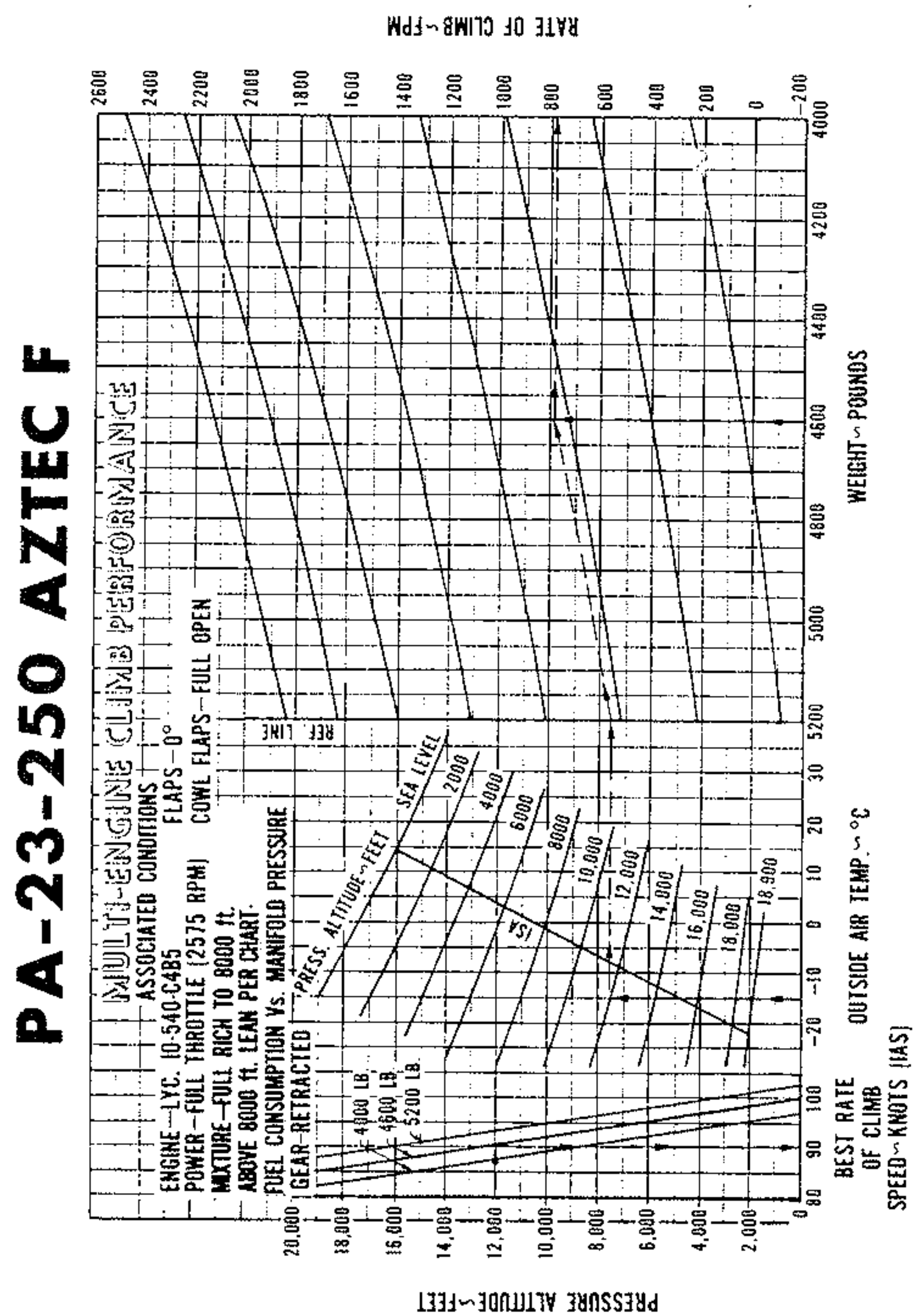


Example:

OAT	= 10° C
Pressure altitude	= 4000 ft.
Slope	= +1.0%
Weight	= 4800 lbs.
Wind	= 15 kts.
Accelerate - stop distance	= 1800 ft.

ACCELERATE - STOP DISTANCE (TURBO)

Figure 5-19

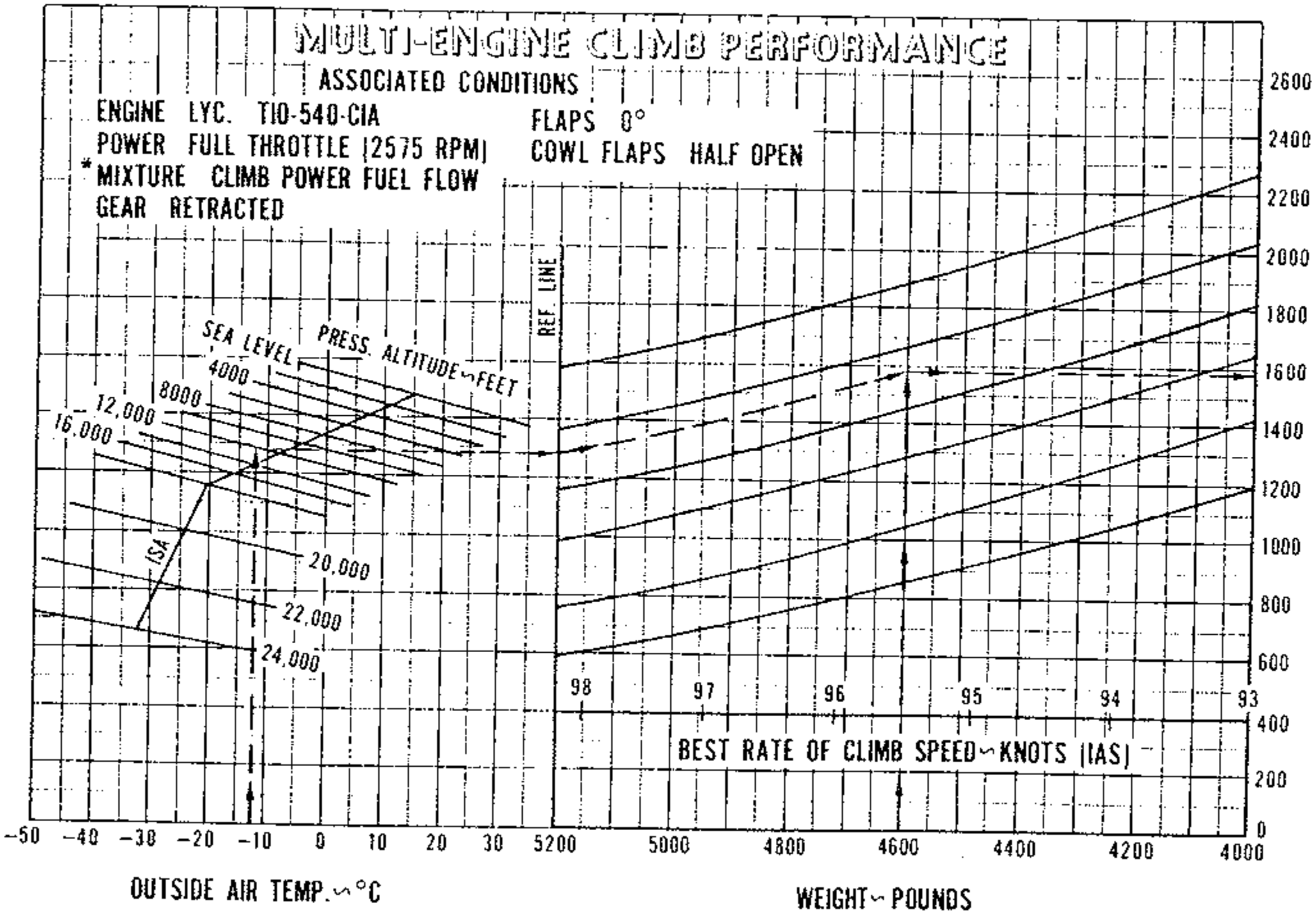


Example:
OAT = -15° C
Pressure altitude = 12000 ft.
Weight = 4600 lbs.
Rate of climb = 780 FPM
Climb speed = 90 KIAS

MULTI-ENGINE CLIMB PERFORMANCE

Figure 5-21

PA-23-250 AZTEC F



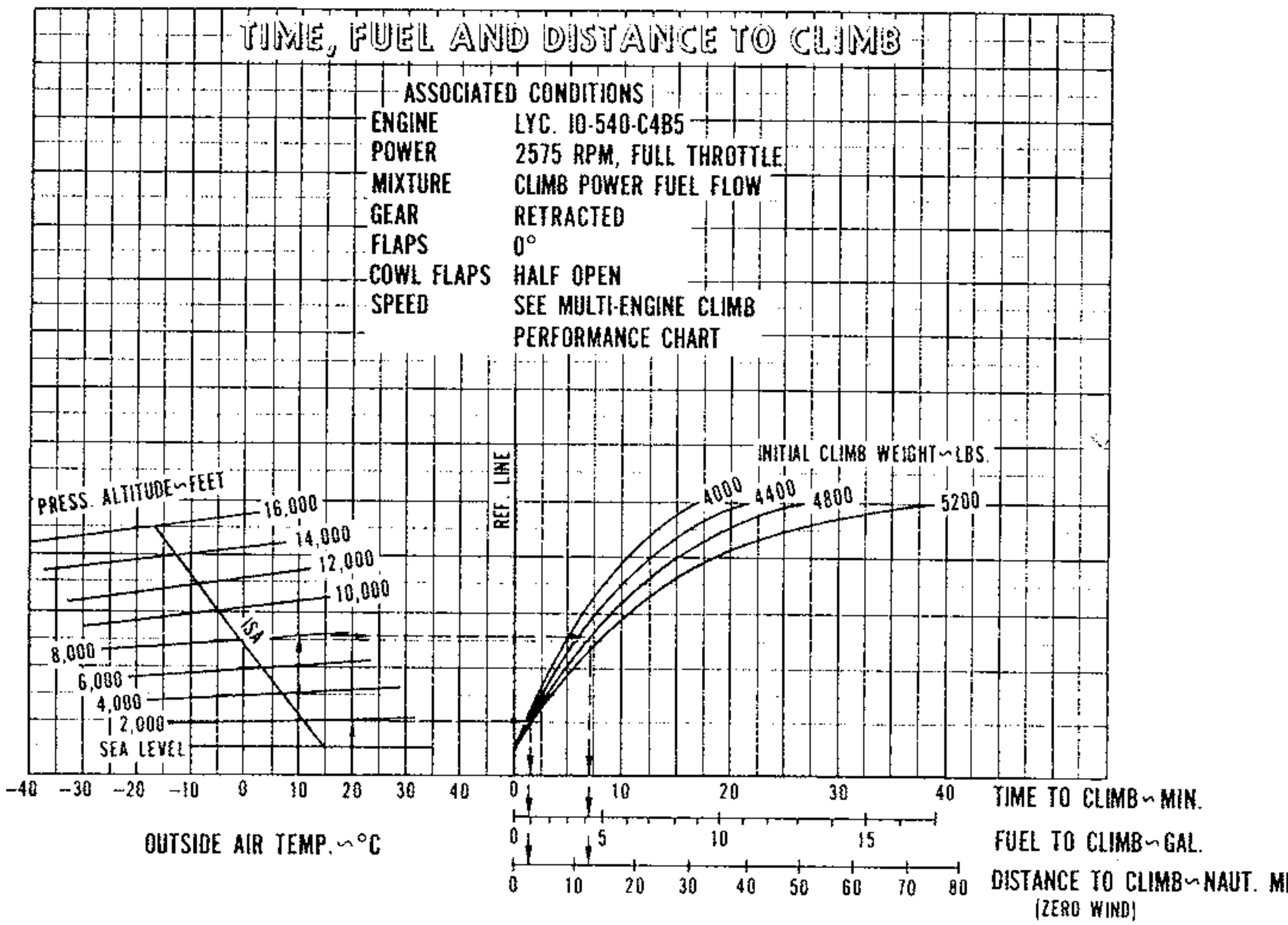
*NOTE: Refer to page 5-41 for leaning instructions.

Example:

OAT	=	-12°C
Pressure altitude	=	12000 ft.
Weight	=	4600 lbs.
Rate of climb	=	1580 FPM
Climb speed	=	95.5 KIAS

MULTI-ENGINE CLIMB PERFORMANCE (TURBO)
Figure 5-23

PA-23-250 AZTEC F

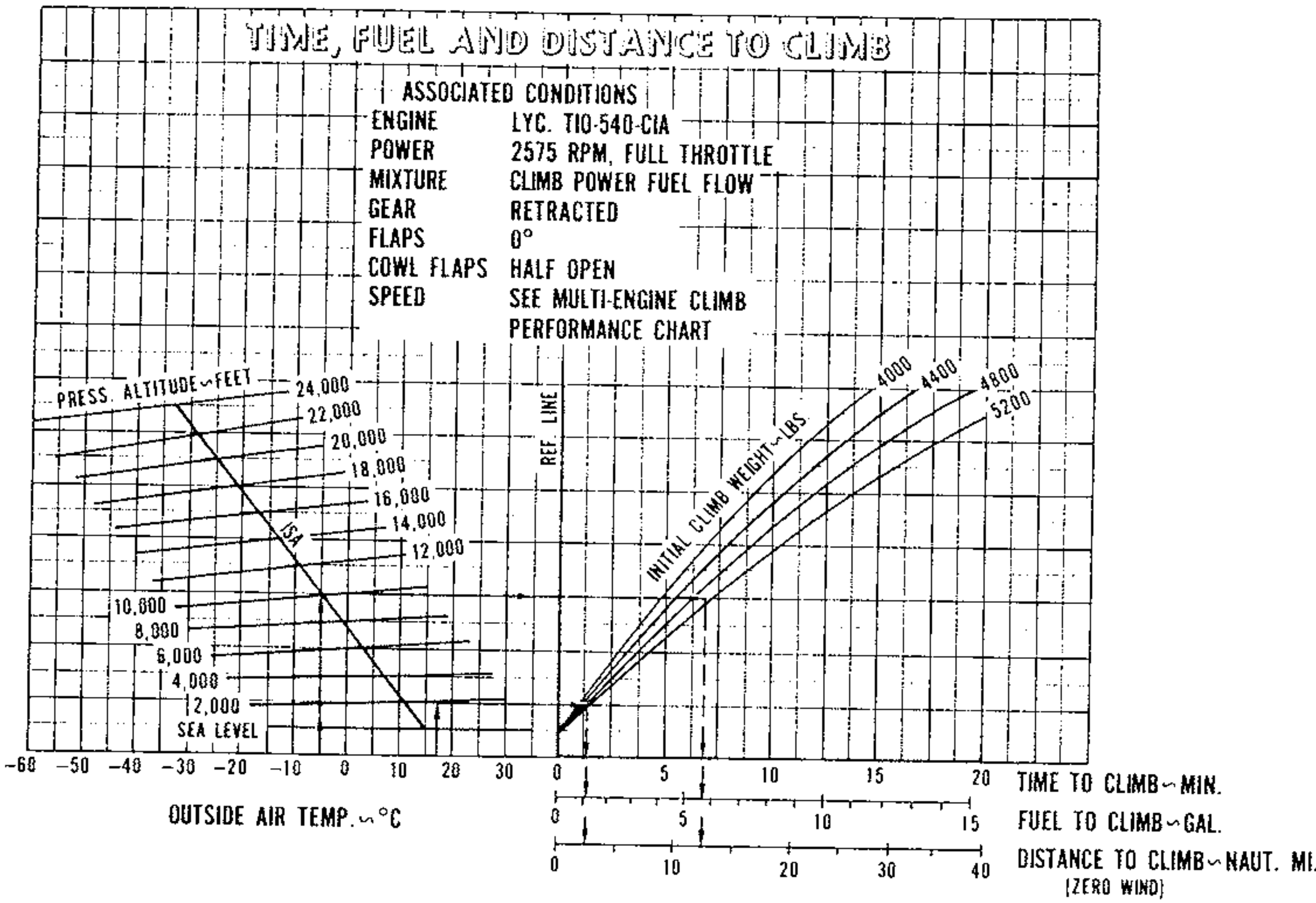


Example:

OAT at airport	=	20° C	Initial climb weight	=	4800 lbs.
OAT at cruise	=	10° C	Time to climb = 7 - 1.5	=	5.5 min.
Pressure altitude at airport	=	2000 ft.	Fuel to climb = 4.1 - .7	=	3.4 gal.
Pressure altitude at cruise	=	8000 ft.	Distance to climb = 12 - 2	=	10 naut. mi.

TIME, FUEL AND DISTANCE TO CLIMB
Figure 5-25

PA-23-250 AZTEC F

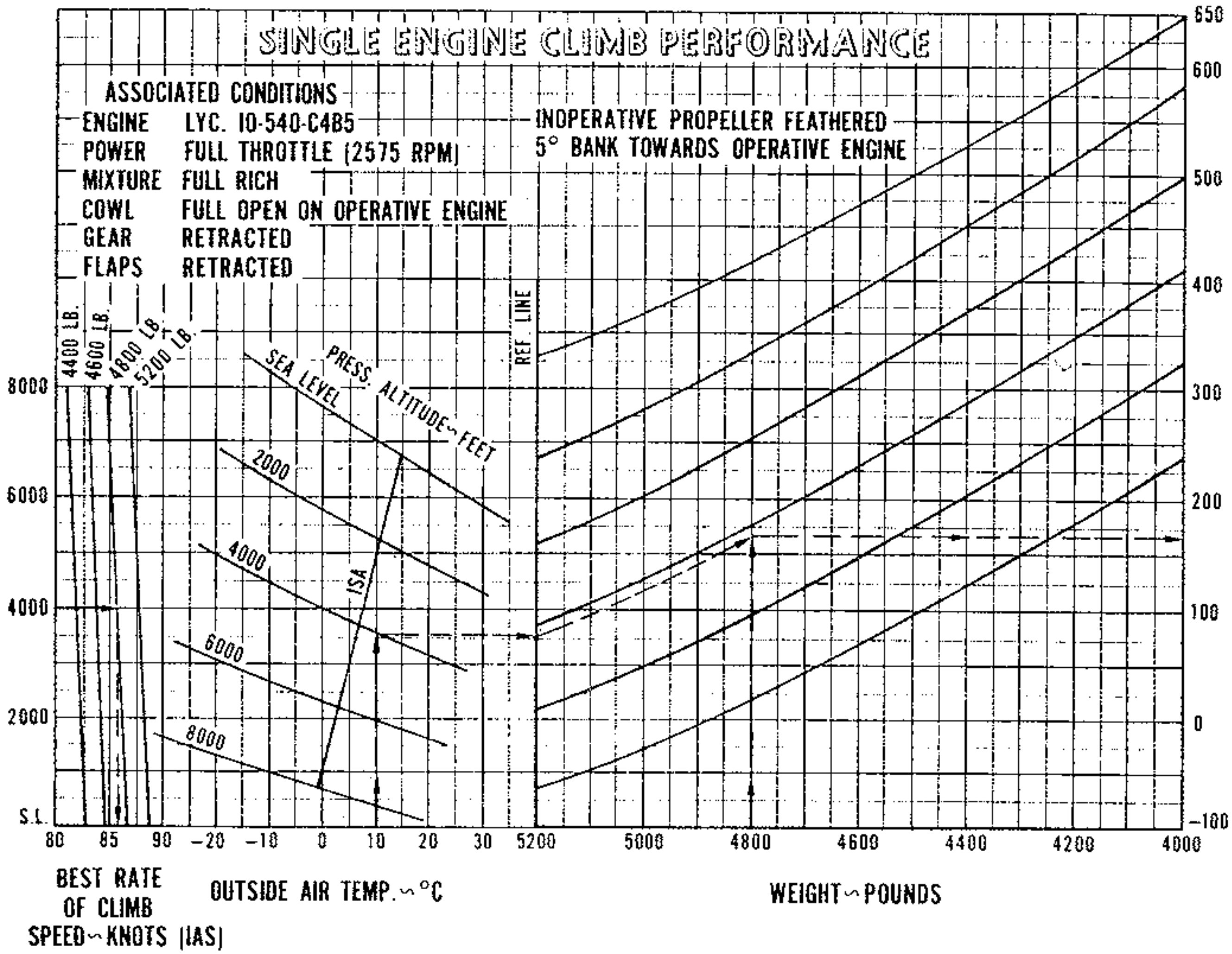


Example:

OAT at airport	= 17° C	Initial climb weight	= 5070 lbs.
OAT at cruise	= -5° C	Time to climb = 6.4 - 1.3	= 5.1 min.
Pressure altitude at airport	= 2000 ft.	Fuel to climb = 5.6 - 1.1	= 4.5 gal.
Pressure altitude at cruise	= 10000 ft.	Distance to climb = 12.5 - 2.5	= 10.0 naut. mi.

TIME, FUEL AND DISTANCE TO CLIMB (TURBO)
Figure 5-27

PA-23-250 AZTEC F

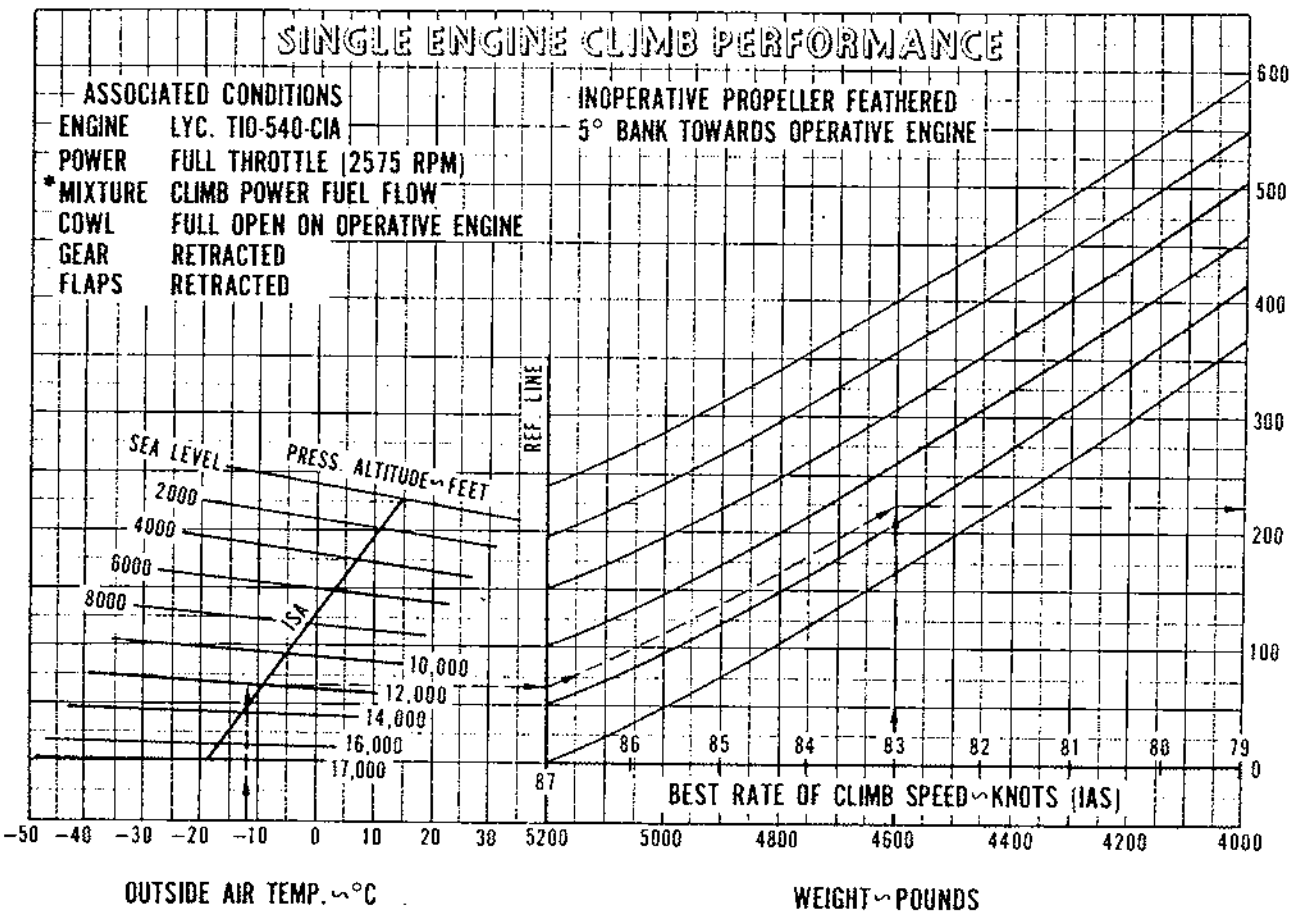


Example:

OAT	= 10° C	Rate of climb	= 165 FPM
Pressure altitude	= 4000 ft.	Climb speed	= 86 KIAS
Weight	= 4800 lbs.		

SINGLE ENGINE CLIMB PERFORMANCE
Figure 5-29

PA-23-250 AZTEC F



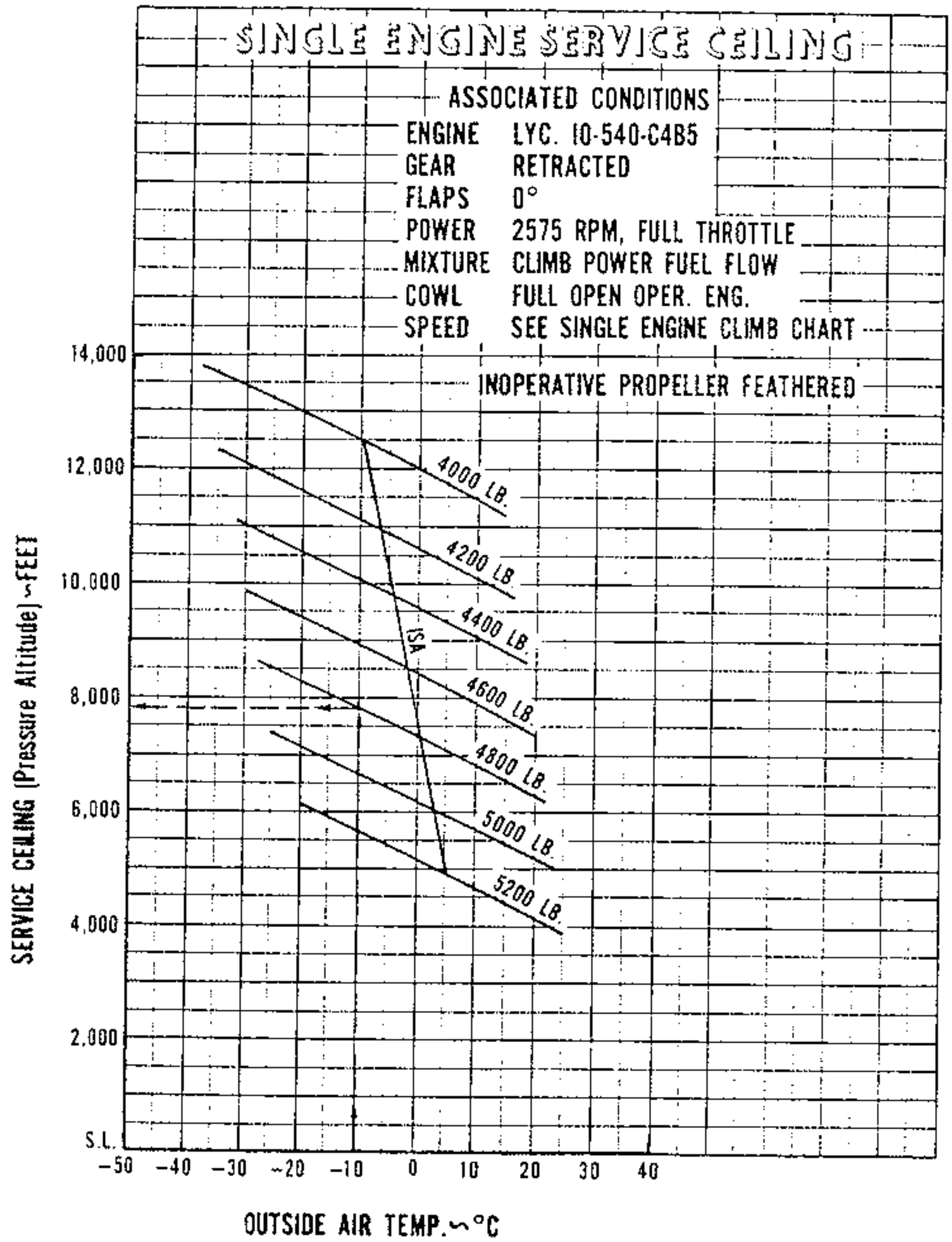
*NOTE: Refer to page 5-41 for leaning instructions.

Example:

OAT	=	-12° C
Pressure altitude	=	12000 ft.
Weight	=	4600 lbs.
Rate of climb	=	225 FPM
Climb speed	=	83 KIAS

SINGLE ENGINE CLIMB PERFORMANCE (TURBO)
Figure 5-31

PA-23-250 AZTEC F



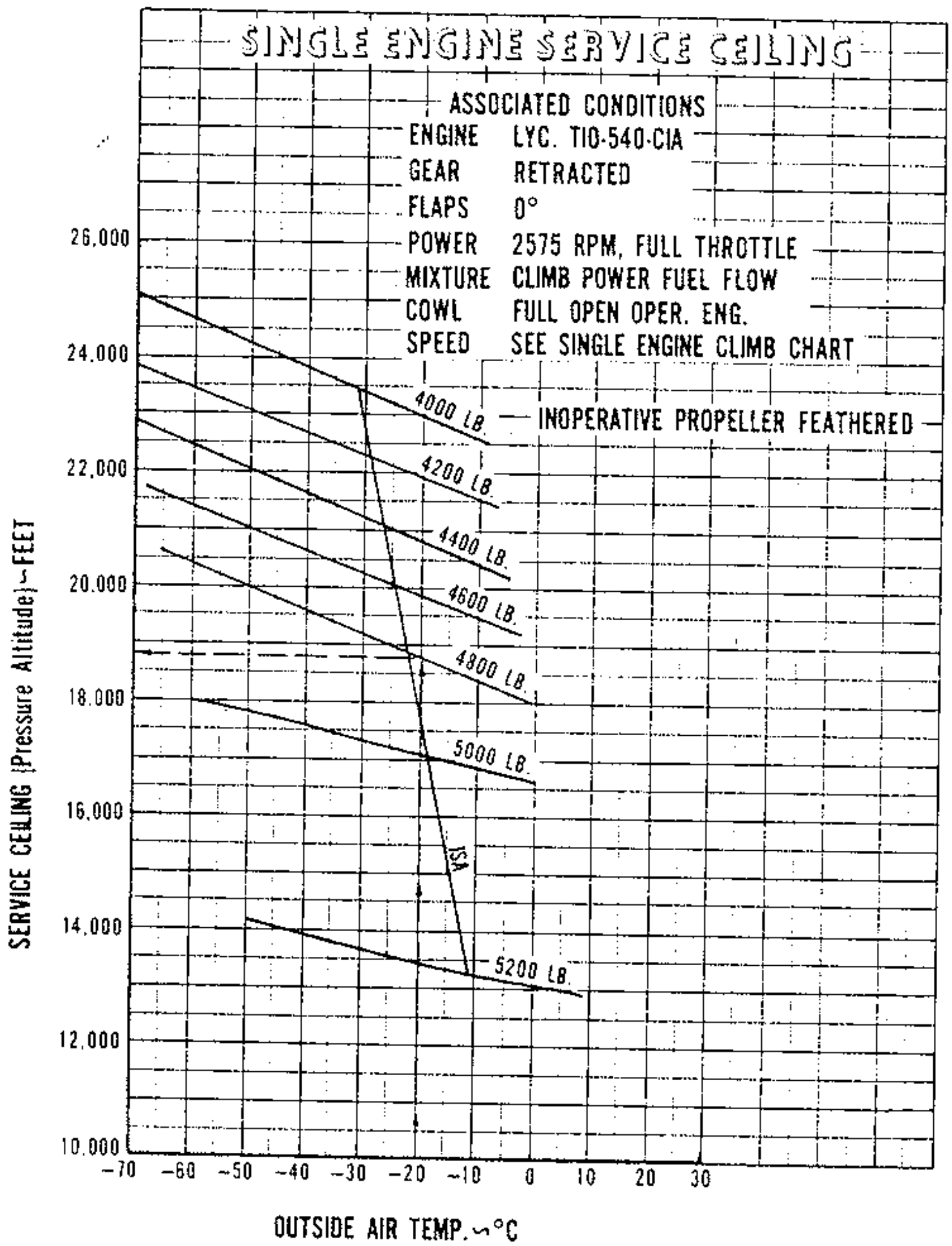
Example:

OAT	=	-10° C
Weight	=	4800 lbs.
Service ceiling	=	7800 ft.

SINGLE ENGINE SERVICE CEILING

Figure 5-33

PA-23-250 AZTEC F



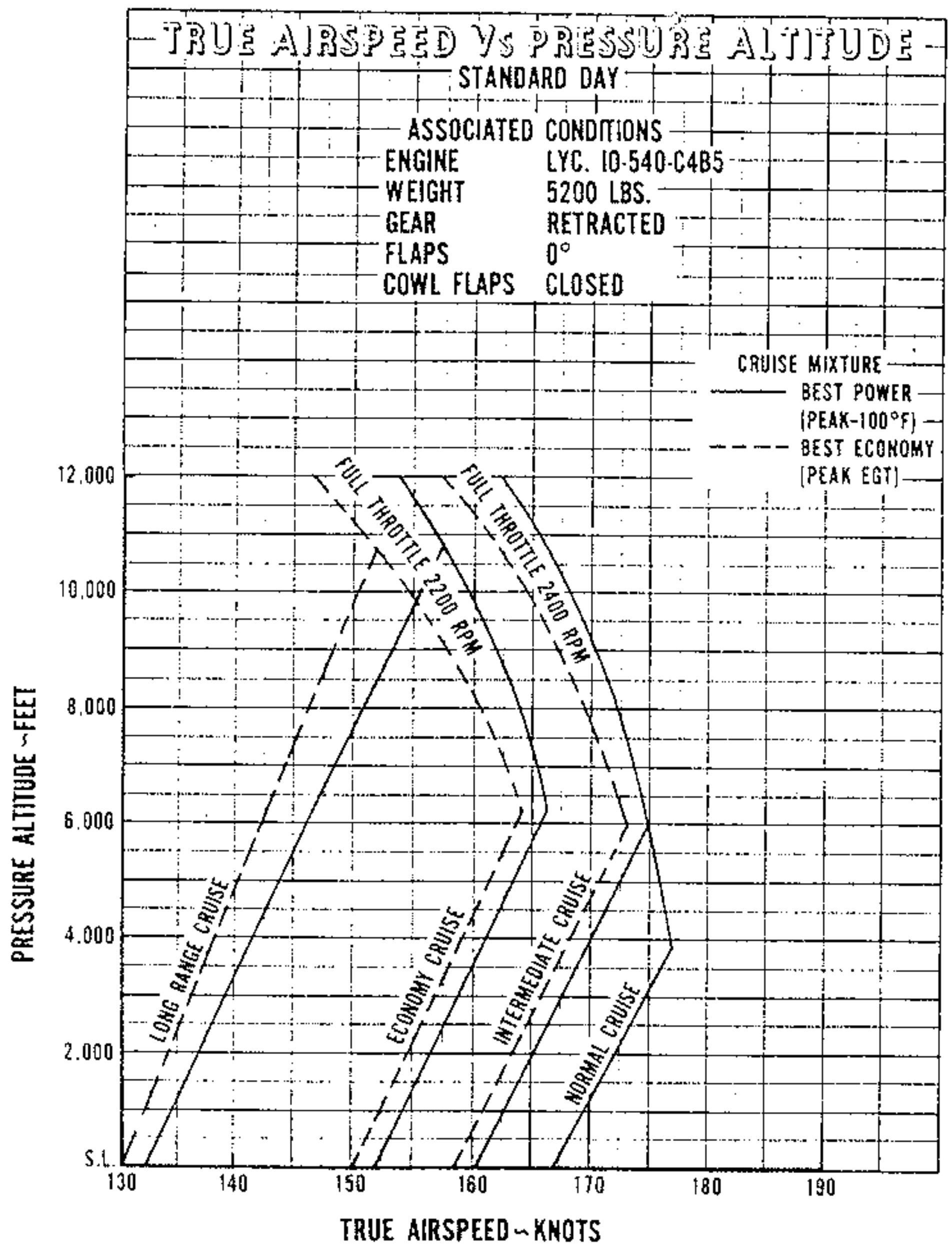
Example:

OAT	=	-20° C
Weight	=	4800 lbs.
Service ceiling	=	18800 ft.

SINGLE ENGINE SERVICE CEILING (TURBO)

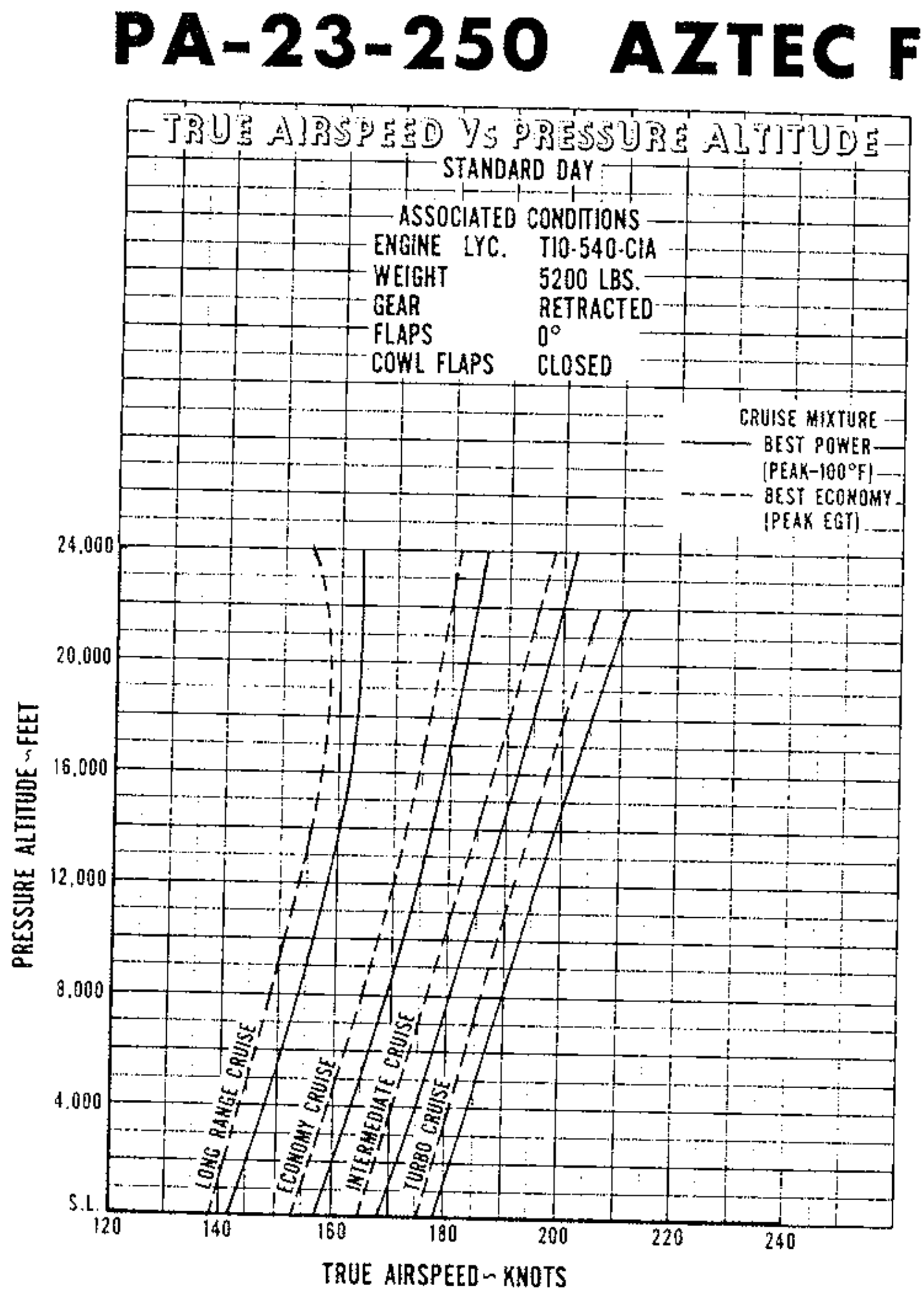
Figure 5-35

PA-23-250 AZTEC F



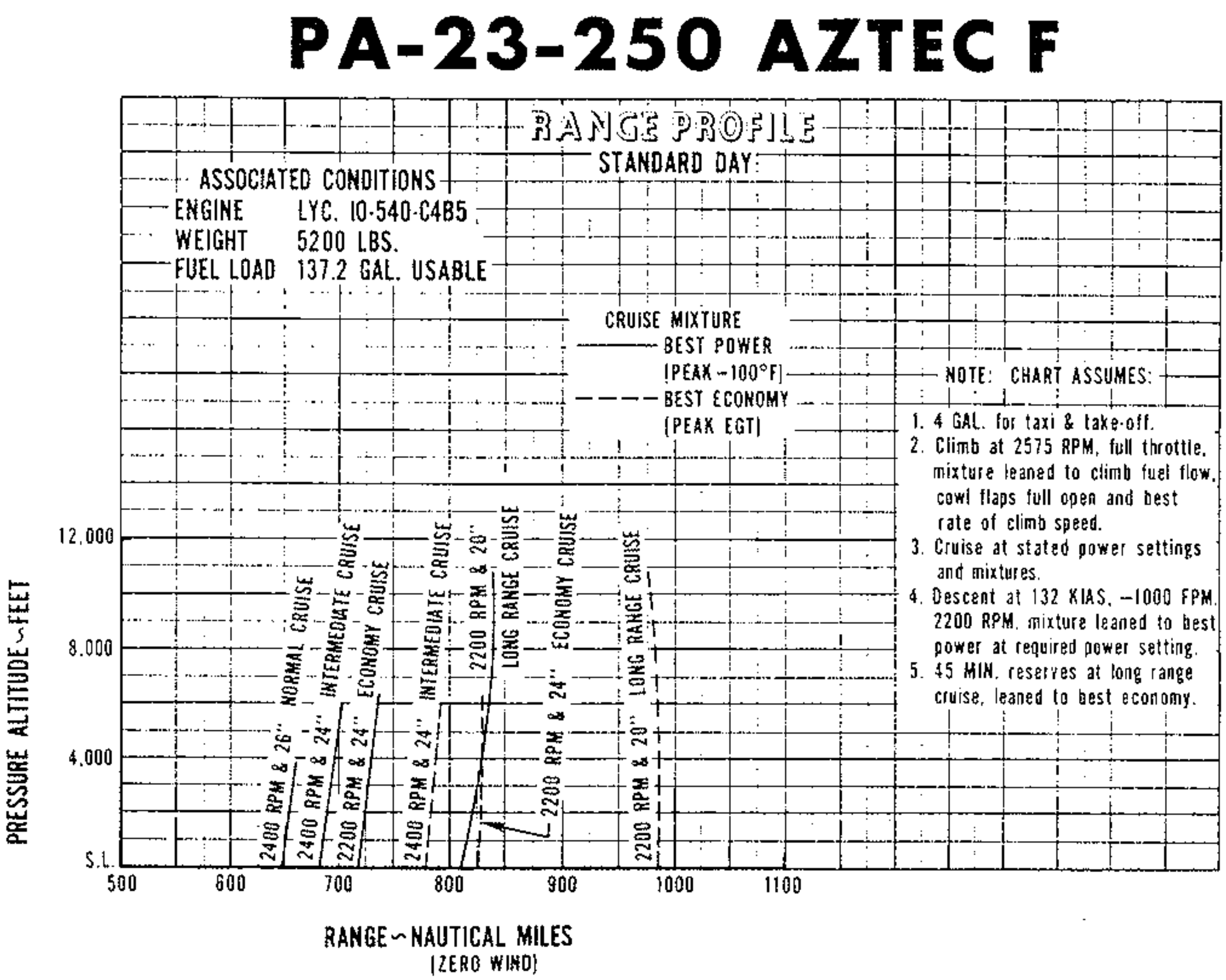
TRUE AIRSPEED VS. PRESSURE ALTITUDE

Figure 5-37



TRUE AIRSPEED VS. PRESSURE ALTITUDE (TURBO)

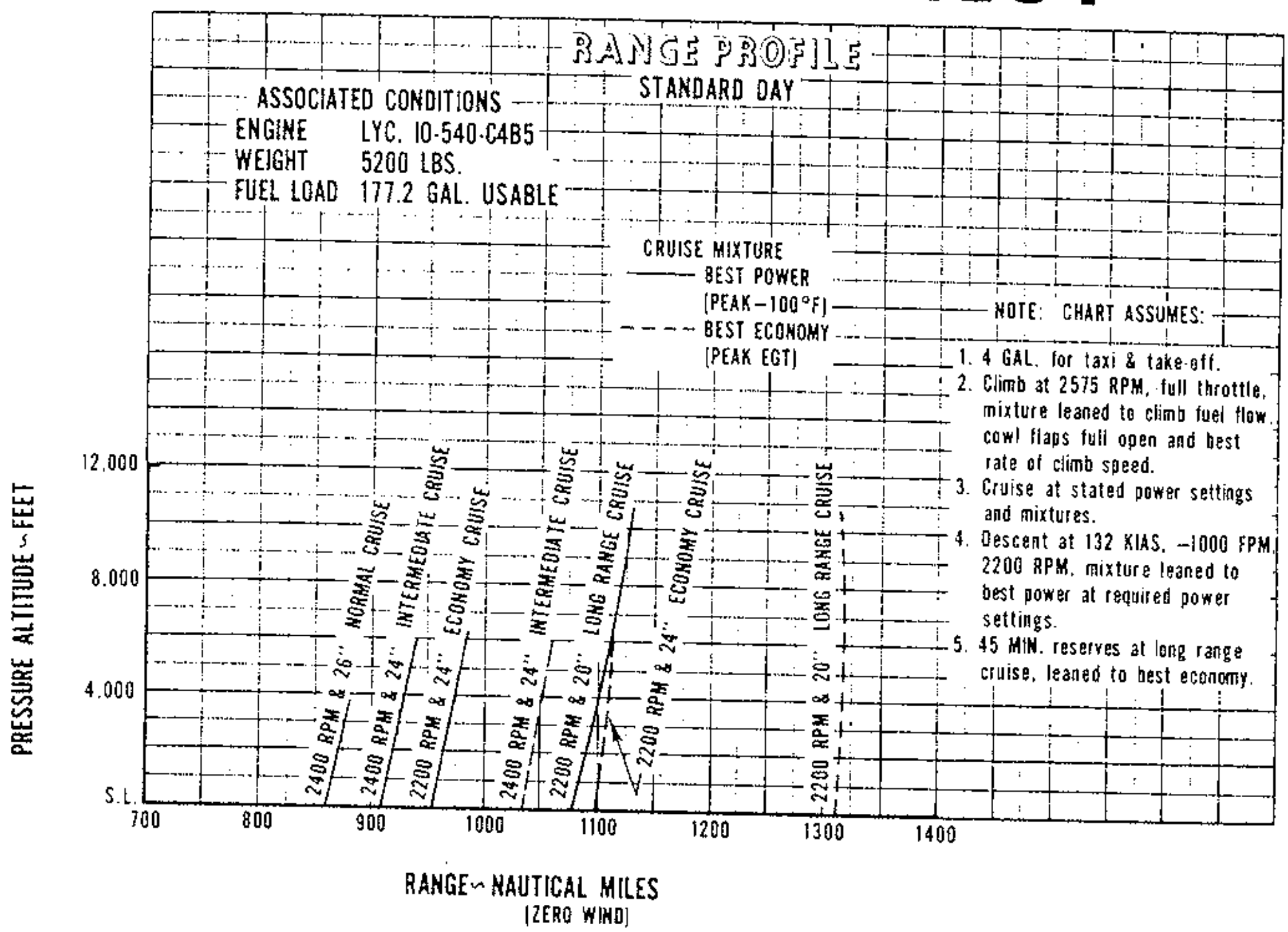
Figure 5-39



RANGE PROFILE

Figure 5-41

PA-23-250 AZTEC F



RANGE PROFILE (OPTIONAL TIP TANKS)

Figure 5-43

PA-23-250 AZTEC F

POWER SETTING TABLE - CRUISE SETTINGS

LYCOMING IO-540-C4B5

Normal Cruise		Intermediate Cruise		Economy Cruise		Long Range Cruise	
RPM	MP	RPM	MP	RPM	MP	RPM	MP
2400	26.0	2200	26.0	2200	24.0	2100	21.0
		2300	25.0	2300	23.2	2200	20.0
		2400	24.0	2400	22.4	2300	19.3

1. To maintain constant power, correct manifold pressure approximately 0.3 IN. HG. for each 10° C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

2. To determine fuel consumption for these power settings refer to the Fuel Consumption Chart.

3. When using Hartzell Propeller HC-E2YR-2RB/8465-7R with IO-540-C4B5 engine, DO NOT EXCEED 27" MANIFOLD PRESSURE BELOW 2300 RPM OR 25" BELOW 2000 RPM.

POWER SETTING TABLE - CRUISE SETTINGS

Figure 5-45

PA-23-250 AZTEC F
CRUISE PERFORMANCE

NORMAL CRUISE - 2400 RPM - 26 IN. HG.* - LYC IO-540-C4B5

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb.		4800 Lb.		4200 Lb.	
				Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)
ISA + 20°C	SL	35.0	31.6/NA	170	Not Approved	172	Not Approved	174	Not Approved
	2000	31.0	32.1/NA	176	Not Approved	178	Not Approved	180	Not Approved
	3850	27.2	32.6/NA	181	Not Approved	183	Not Approved	185	Not Approved
ISA	SL	15.0	31.6/NA	167	Not Approved	169	Not Approved	171	Not Approved
	2000	11.0	32.1/NA	172	Not Approved	174	Not Approved	176	Not Approved
	3850	7.2	32.6/NA	177	Not Approved	179	Not Approved	181	Not Approved
ISA - 20°C	SL	- 5.0	31.6/NA	163	Not Approved	165	Not Approved	167	Not Approved
	2000	- 9.0	32.1/NA	168	Not Approved	170	Not Approved	172	Not Approved
	3850	-12.8	32.6/NA	173	Not Approved	175	Not Approved	177	Not Approved

*Correct manifold pressure approximately 0.3 IN. HG. for each 10° C variation in induction air temperature from standard altitude temperature. Add manifold pressure above standard; subtract for temperatures below standard.

CRUISE PERFORMANCE - NORMAL CRUISE

Figure 5-47

PA-23-250 AZTEC F
CRUISE PERFORMANCE

INTERMEDIATE CRUISE - 2400 RPM - 24 IN. HG.* - LYC IO-540-C4B5

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb. Best Power (Knots)	5200 Lb. Best Economy (Knots)	4800 Lb. Best Power (Knots)	4800 Lb. Best Economy (Knots)	4200 Lb. Best Power (Knots)	4200 Lb. Best Economy (Knots)
ISA + 20°C	SL	35.0	28.6/24.9	163	161	165	163	167	165
	2000	31.0	29.0/25.3	168	166	170	168	172	170
	4000	27.1	29.4/25.7	173	171	175	173	177	175
	6000	23.1	29.8/26.1	178	176	180	178	182	180
ISA	SL	15.0	28.6/24.9	160	158	162	160	164	162
	2000	11.0	29.0/25.3	165	163	167	165	169	167
	4000	7.1	29.4/25.7	170	168	172	170	174	172
	6000	3.1	29.8/26.1	175	173	177	175	179	177
ISA - 20°C	SL	- 5.0	28.6/24.9	156	155	158	157	160	159
	2000	- 9.0	29.0/25.3	161	160	163	162	165	164
	4000	-13.9	29.4/25.7	165	164	167	166	168	167
	6000	-16.9	29.8/26.1	170	169	173	171	175	173

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure above standard; subtract for temperatures below standard.

CRUISE PERFORMANCE - INTERMEDIATE CRUISE

Figure 5-49

PA-23-250 AZTEC F
CRUISE PERFORMANCE

ECONOMY CRUISE - 2200 RPM - 24 IN. HG.* - LYC IO-540-C4B5

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb. Best Power (Knots)	5200 Lb. Best Economy (Knots)	4800 Lb. Best Power (Knots)	4800 Lb. Best Economy (Knots)	4200 Lb. Best Power (Knots)	4200 Lb. Best Economy (Knots)
ISA + 20°C	SL	35.0	26.0/22.4	154	153	157	156	160	158
	2000	31.0	26.4/22.8	159	157	162	160	165	163
	4000	27.1	26.8/23.2	164	162	167	165	170	168
	6250	22.5	27.3/23.7	170	168	173	171	176	174
ISA	SL	15.0	26.0/22.4	152	150	154	153	157	156
	2000	11.0	26.4/22.8	156	155	159	157	161	160
	4000	7.1	26.8/23.2	161	159	164	162	167	165
	6250	2.5	27.3/23.7	166	164	170	167	172	170
ISA - 20°C	SL	- 5.0	26.0/22.4	149	147	151	149	153	152
	2000	- 9.0	26.4/22.8	153	152	156	154	158	157
	4000	-13.9	26.8/23.2	158	156	161	158	163	161
	6250	-17.5	27.3/23.7	163	161	166	164	169	167

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure above standard; subtract for temperatures below standard.

CRUISE PERFORMANCE - ECONOMY CRUISE

Figure 5-51

PA-23-250 AZTEC F
CRUISE PERFORMANCE

LONG RANGE CRUISE - 2200 RPM - 20 IN. HG.* - LYC IO-540-C4B5

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb. Best Power (Knots)	5200 Lb. Best Economy (Knots)	4800 Lb. Best Power (Knots)	4800 Lb. Best Economy (Knots)	4200 Lb. Best Power (Knots)	4200 Lb. Best Economy (Knots)
ISA + 20°C	SL	35.0	20.2/16.4	133	131	138	136	143	141
	2000	31.0	20.6/16.8	138	136	143	141	148	147
	4000	27.1	21.0/17.2	143	141	148	146	153	151
	6000	22.5	21.6/17.6	149	145	154	150	159	155
	8000	19.2	21.8/18.0	153	149	158	154	163	159
	10800	13.4	22.4/18.6	160	153	165	158	170	163
ISA	SL	15.0	20.2/16.4	132	130	136	134	140	139
	2000	11.0	20.6/16.8	137	134	141	138	145	143
	4000	7.1	21.0/17.2	141	138	145	142	150	148
	6000	2.5	21.6/17.6	146	142	150	147	155	152
	8000	- 0.8	21.8/18.0	151	146	155	152	160	157
	10800	- 6.6	22.4/18.6	157	152	162	158	166	163
ISA - 20°C	SL	- 5.0	20.2/16.4	129	128	133	132	137	136
	2000	- 9.0	20.6/16.8	134	132	138	136	142	140
	4000	-13.9	21.0/17.2	139	137	143	141	147	145
	6000	-17.5	21.6/17.6	144	141	148	145	152	149
	8000	-20.8	21.8/18.0	149	145	153	149	157	154
	10800	-26.6	22.4/18.6	155	151	159	155	163	160

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure above standard; subtract for temperatures below standard.

CRUISE PERFORMANCE - LONG RANGE CRUISE

Figure 5-53

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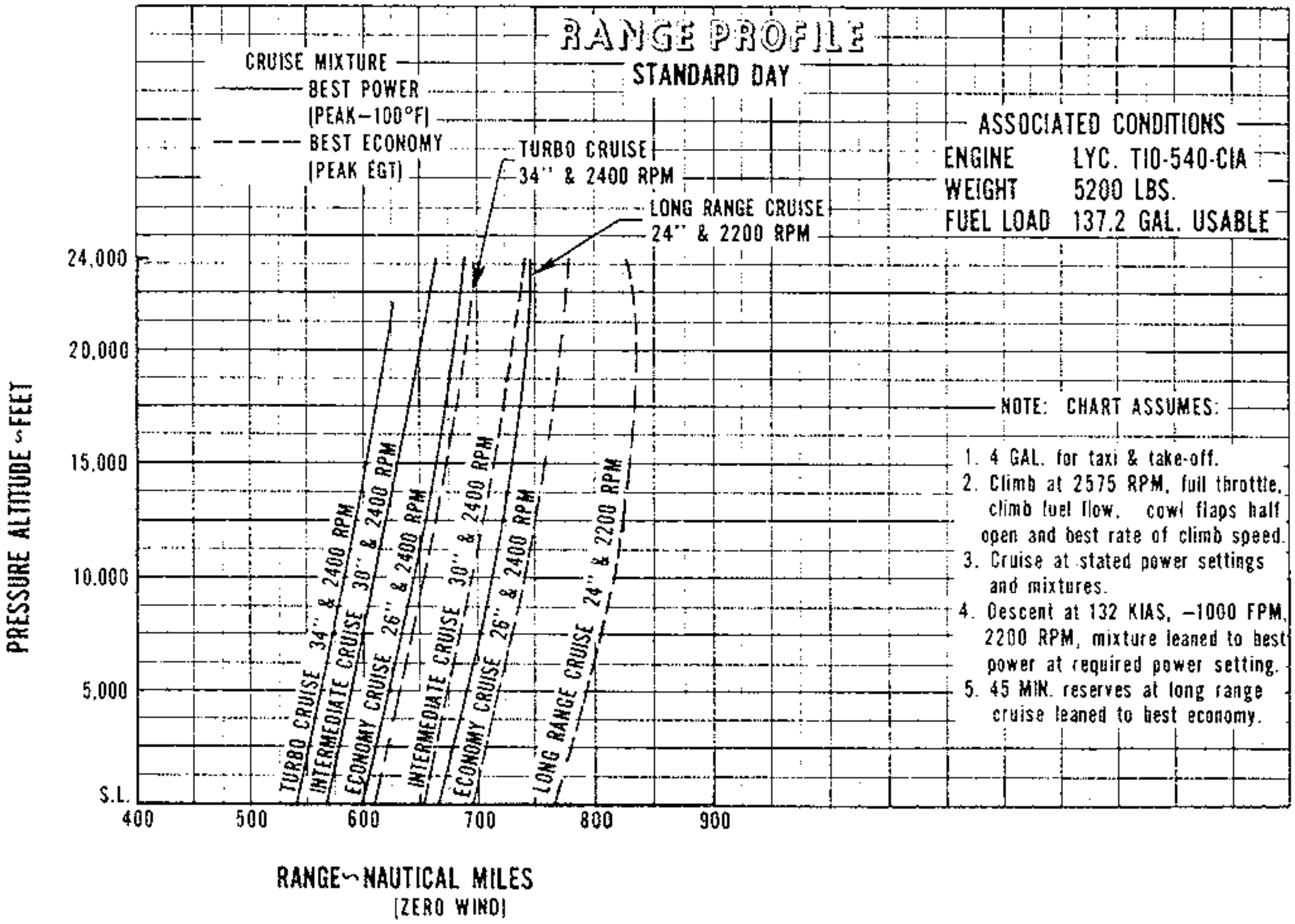
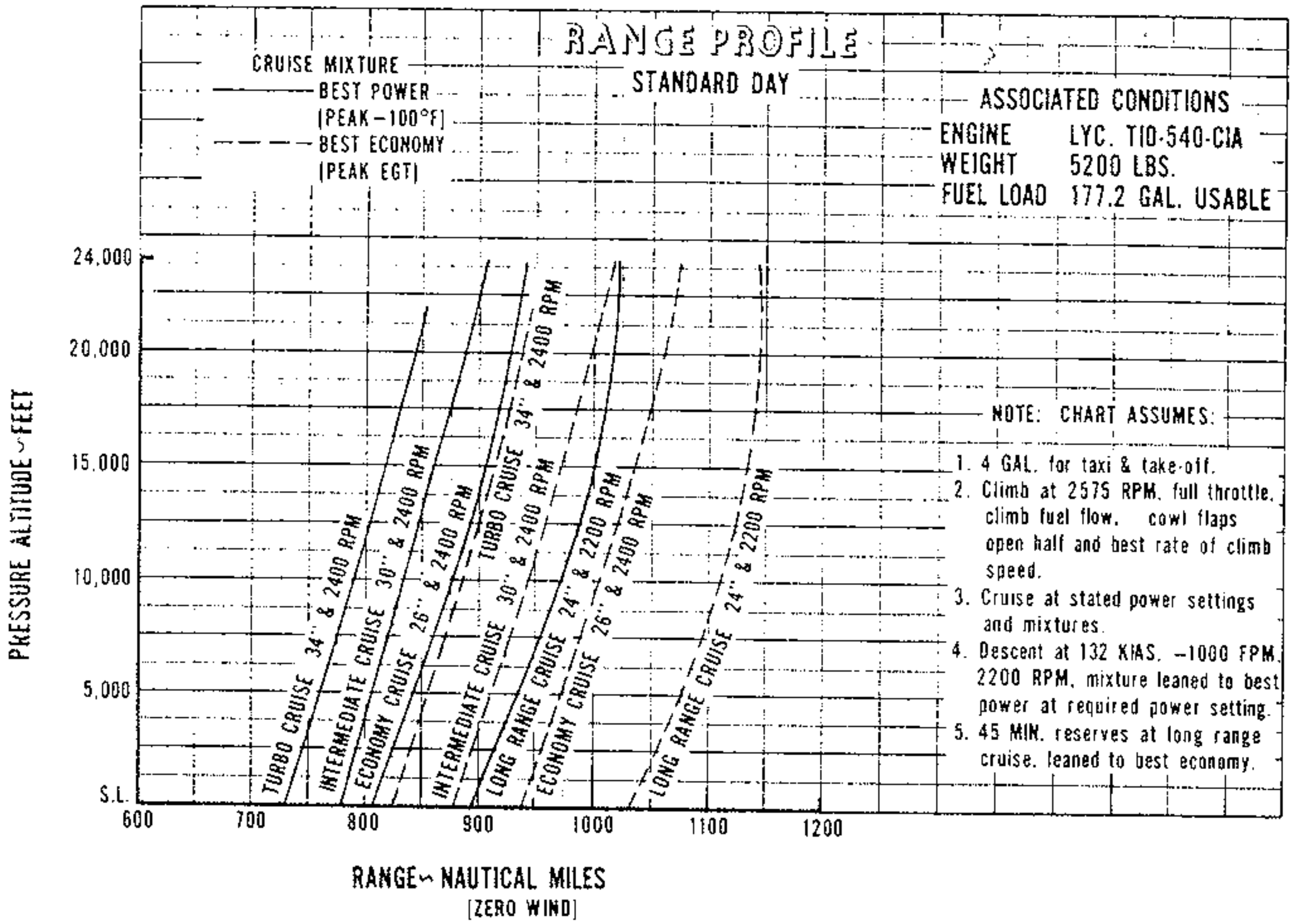
PA-23-250 AZTEC F



RANGE PROFILE (TURBO)

Figure 5-55

PA-23-250 AZTEC F



RANGE PROFILE (TURBO - OPTIONAL TIP TANKS)

Figure 5-57

PA-23-250 AZTEC F

POWER SETTING TABLE - CRUISE SETTINGS

LYCOMING TIO-540-C1A

Turbo Cruise		Intermediate Cruise		Economy Cruise		Long Range Cruise	
RPM	MP	RPM	MP	RPM	MP	RPM	MP
2400	34.0	2300	31.0	2200	28.0	2100	25.0
		2400	30.0	2300	27.0	2200	24.0
		2500	29.0	2400	26.0	2300	23.0

1. To maintain constant power, correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard. Do not exceed 34.0 IN. M.P. at 2400 RPM with mixture strength less than full rich.

2. To determine fuel consumption for these power settings refer to the Fuel Consumption Chart.

3. Do not exceed 39.5" Hg. up to 18,500 feet. Above 18,500 feet the following manifold limits must be observed:

ALTITUDE	M.P.
20,000 Ft.	37.0"
22,000 Ft.	34.0"
24,000 Ft.	31.0"

POWER SETTING TABLE - CRUISE SETTINGS (TURBO)

Figure 5-59

PA-23-250 AZTEC F
CRUISE PERFORMANCE

TURBO CRUISE - 2400 RPM - 34 IN. HG.* - LYC TIO-540-C1A ENG.

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb. Best Power (Knots)	5200 Lb. Best Economy (Knots)	4800 Lb. Best Power (Knots)	4800 Lb. Best Economy (Knots)	4200 Lb. Best Power (Knots)	4200 Lb. Best Economy (Knots)
ISA + 20°C	SL	35.0	37.6/32.6	179	175	181	177	183	179
	5000	25.1	37.6/32.6	186	182	189	185	191	187
	10000	15.2	37.6/32.6	193	190	197	193	199	195
	15000	5.3	37.6/32.6	201	197	205	201	208	204
	20000	- 4.6	37.6/32.6	208	204	213	208	217	212
	22000	- 8.5	37.6/32.6	211	206	216	211	220	216
ISA	SL	15.0	38.0/33.0	178	175	180	176	182	178
	5000	5.1	38.0/33.0	185	182	187	184	190	186
	10000	- 4.8	38.0/33.0	193	189	195	192	198	195
	15000	-14.7	28.0/33.0	200	196	203	199	206	202
	20000	-24.6	38.0/33.0	208	203	211	207	215	211
	22000	-28.5	38.0/33.0	211	206	215	210	218	214
ISA - 20°C	SL	- 5.0	38.0/33.0	173	170	175	172	177	174
	5000	-14.9	38.0/33.0	181	177	183	180	185	182
	10000	-24.8	38.0/33.0	188	184	191	187	193	190
	15000	-34.7	38.0/33.0	196	192	199	195	202	198
	20000	-44.6	38.0/33.0	203	199	207	202	210	206
	22000	-48.5	38.0/33.0	206	202	210	206	213	209

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard. Do not exceed 34.0 IN. M.P. at 2400 RPM with mixture strength less than full rich.

CRUISE PERFORMANCE - TURBO CRUISE (TURBO)

Figure 5-61

PA-23-250 AZTEC F
CRUISE PERFORMANCE

INTERMEDIATE CRUISE - 2400 RPM - 30 IN. HG.* - LYC TIO-540-C1A ENG.

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb.		4800 Lb.		4200 Lb.	
				Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)
ISA + 20°C	SL	35.0	34.2/29.3	171	168	173	171	176	173
	5000	25.1	34.2/29.3	178	175	181	178	184	181
	10000	15.2	34.2/29.3	186	182	189	186	192	189
	15000	5.3	34.2/29.3	193	189	197	193	201	197
	20000	- 4.6	34.2/29.3	201	196	205	201	210	206
	24000	-12.6	34.2/29.3	206	200	211	206	217	213
ISA	SL	15.0	34.2/29.3	168	165	170	167	172	169
	5000	5.1	34.2/29.3	176	172	178	174	180	177
	10000	- 4.8	34.2/29.3	183	179	186	182	188	185
	15000	-14.7	34.2/29.3	190	186	193	189	196	193
	20000	-24.6	34.2/29.3	197	193	201	197	205	201
	24000	-32.5	34.2/29.3	202	198	208	203	212	208
ISA - 20°C	SL	- 5.0	34.2/29.3	164	161	166	163	168	165
	5000	-14.9	34.2/29.3	171	167	173	170	176	172
	10000	-24.8	34.2/29.3	178	174	181	177	184	180
	15000	-34.7	34.2/29.3	185	181	189	185	192	188
	20000	-44.6	34.2/29.3	193	188	196	192	200	196
	24000	-52.5	34.2/29.3	199	193	203	198	207	203

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard. Do not exceed 34.0 IN. M.P. at 2400 RPM with mixture strength less than full rich.

CRUISE PERFORMANCE - INTERMEDIATE CRUISE (TURBO)

Figure 5-63

PA-23-250 AZTEC F
CRUISE PERFORMANCE

ECONOMY CRUISE - 2400 RPM - 26 IN. HG.* - LYC TIO-540-C1A ENG.

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb. Best Power (Knots)	5200 Lb. Best Economy (Knots)	4800 Lb. Best Power (Knots)	4800 Lb. Best Economy (Knots)	4200 Lb. Best Power (Knots)	4200 Lb. Best Economy (Knots)
ISA + 20 °C	SL	35.0	30.4/25.7	160	156	162	159	165	162
	5000	25.1	30.4/25.7	167	164	170	167	173	170
	10000	15.2	30.4/25.7	175	171	178	174	181	177
	15000	5.3	30.4/25.7	181	176	185	181	189	185
	20000	- 4.6	30.4/25.7	186	180	192	187	197	193
	24000	-12.6	30.4/25.7	188	182	196	191	204	199
ISA	SL	15.0	30.4/25.7	157	153	159	156	162	158
	5000	5.1	30.4/25.7	165	161	167	164	170	167
	10000	- 4.8	30.4/25.7	172	168	175	171	178	174
	15000	-14.7	30.4/25.7	178	173	182	177	186	182
	20000	-24.6	30.4/25.7	183	178	188	183	193	189
	24000	-32.5	30.4/25.7	186	181	193	188	199	195
ISA - 20 °C	SL	- 5.0	30.4/25.7	153	150	155	152	157	155
	5000	-14.9	30.4/25.7	161	157	163	160	166	163
	10000	-24.8	30.4/25.7	168	164	171	168	174	171
	15000	-34.7	30.4/25.7	174	170	177	174	181	178
	20000	-44.6	30.4/25.7	180	175	184	181	189	186
	24000	-52.5	30.4/25.7	184	178	189	185	195	191

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard. Do not exceed 34.0 IN. M.P. at 2400 RPM with mixture strength less than full rich.

CRUISE PERFORMANCE - ECONOMY CRUISE (TURBO)

Figure 5-65

PA-23-250 AZTEC F
CRUISE PERFORMANCE

LONG RANGE CRUISE - 2200 RPM - 24 IN. HG.* - LYC TIO-540-C1A ENG.

	Pressure Altitude Feet	OAT °C	Fuel Flow GPH B.P./B.E.	5200 Lb.		4800 Lb.		4200 Lb.	
				Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)	Best Power (Knots)	Best Economy (Knots)
ISA + 20°C	SL	35.0	25.0/21.2	144	140	147	144	150	147
	5000	25.1	25.0/21.2	152	148	155	152	159	156
	10000	15.2	25.0/21.2	158	154	163	159	168	164
	15000	5.3	25.0/21.2	163	158	169	165	175	172
	20000	- 4.6	25.0/21.2	165	158	174	168	183	178
	24000	-12.6	25.0/21.2	164	153	175	169	186	182
ISA	SL	15.0	25.0/21.2	142	138	145	141	148	145
	5000	5.1	25.0/21.2	149	145	153	149	157	153
	10000	- 4.8	25.0/21.2	156	151	160	156	165	161
	15000	-14.7	25.0/21.2	161	156	166	162	172	169
	20000	-24.6	25.0/21.2	164	158	171	165	179	174
	24000	-32.5	25.0/21.2	164	158	174	167	183	177
ISA - 20°C	SL	- 5.0	25.0/21.2	140	136	143	139	145	142
	5000	-14.9	25.0/21.2	146	143	150	146	154	150
	10000	-24.8	25.0/21.2	153	149	157	153	161	158
	15000	-34.7	25.0/21.2	158	154	163	159	168	164
	20000	-44.6	25.0/21.2	163	158	169	165	175	171
	24000	-52.5	25.0/21.2	163	156	172	165	180	173

*Correct manifold pressure approximately 0.3 IN. HG. for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard. Do not exceed 34.0 IN. M.P. at 2400 RPM with mixture strength less than full rich.

CRUISE PERFORMANCE - LONG RANGE CRUISE (TURBO)

Figure 5-67

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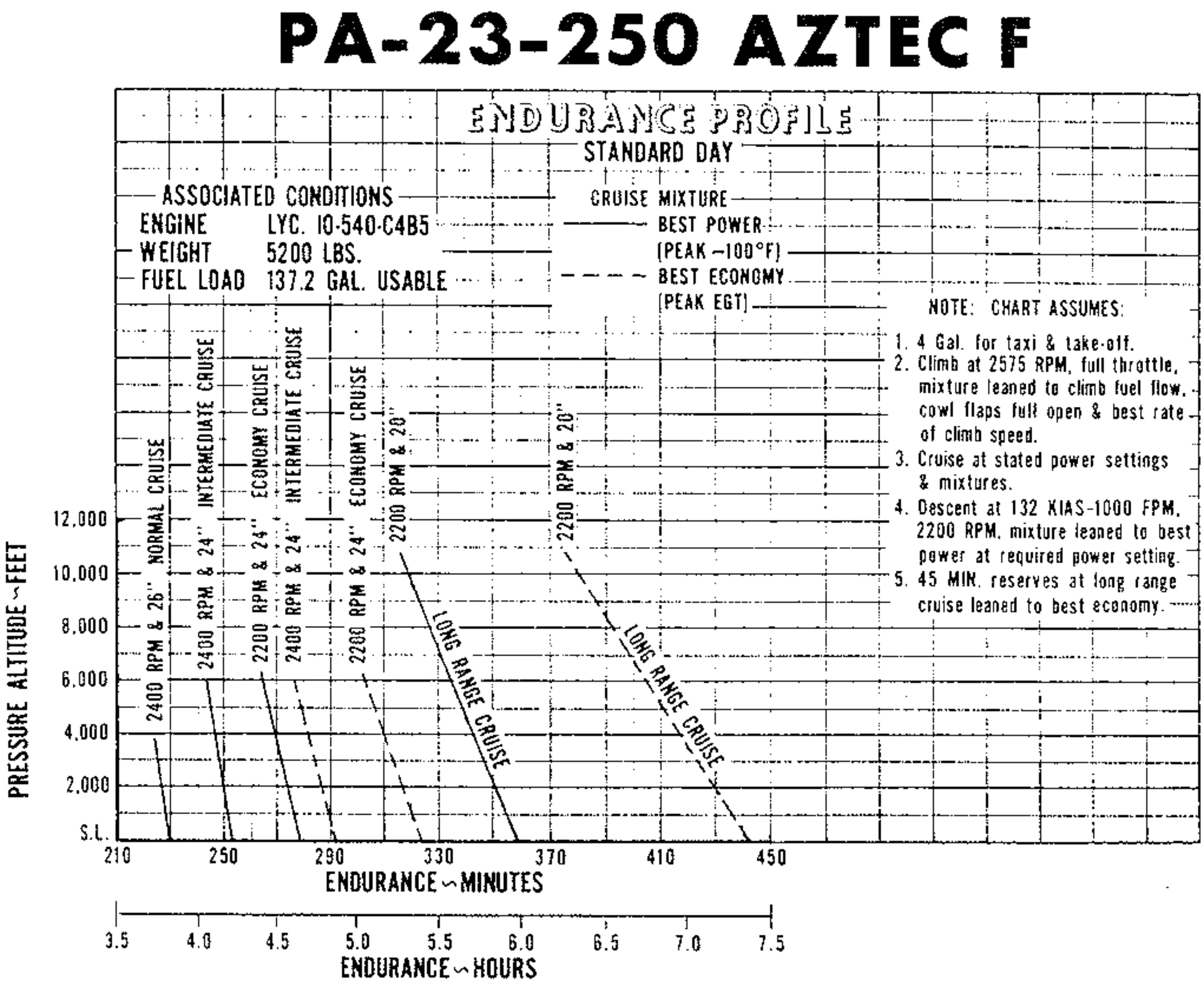
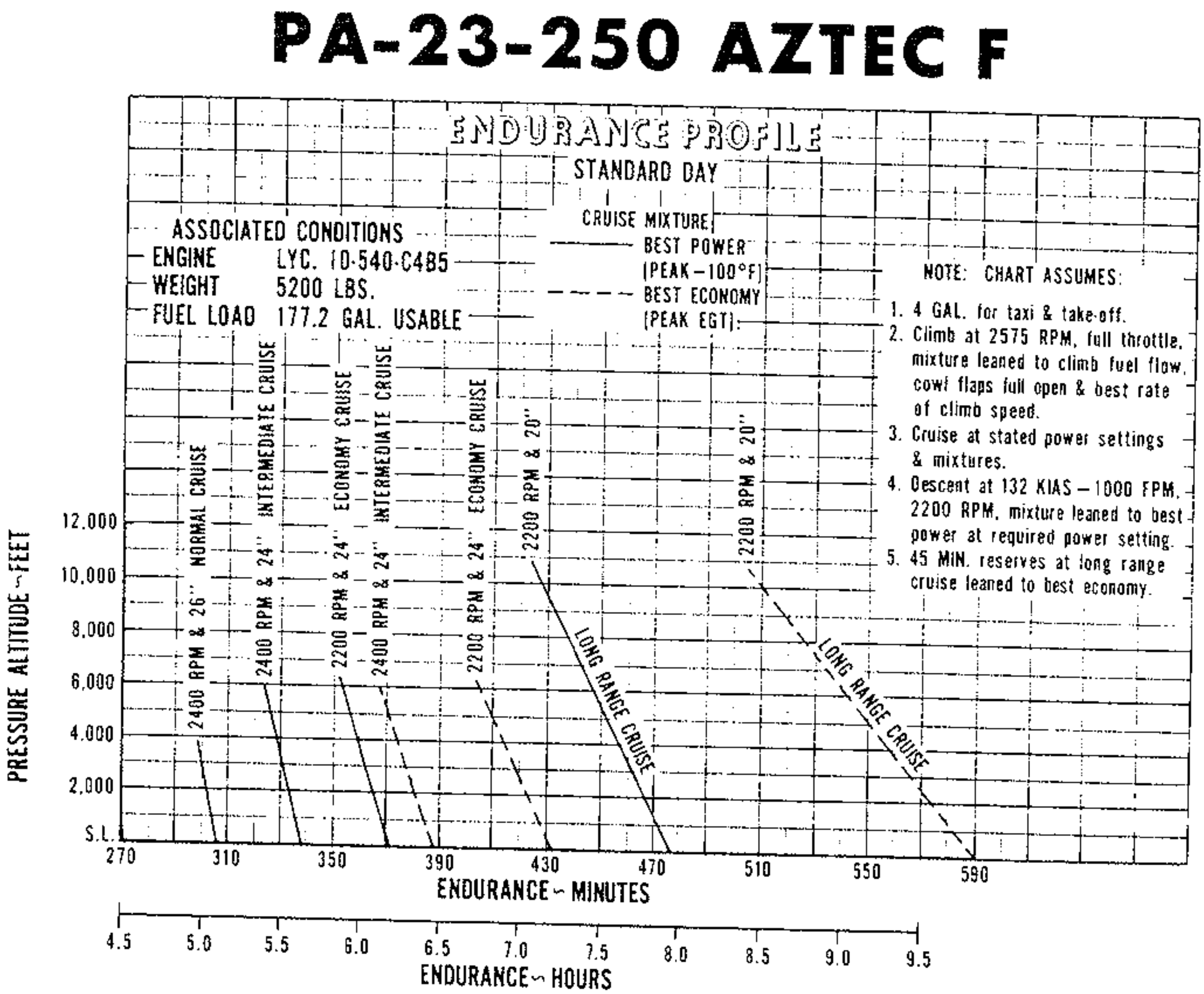


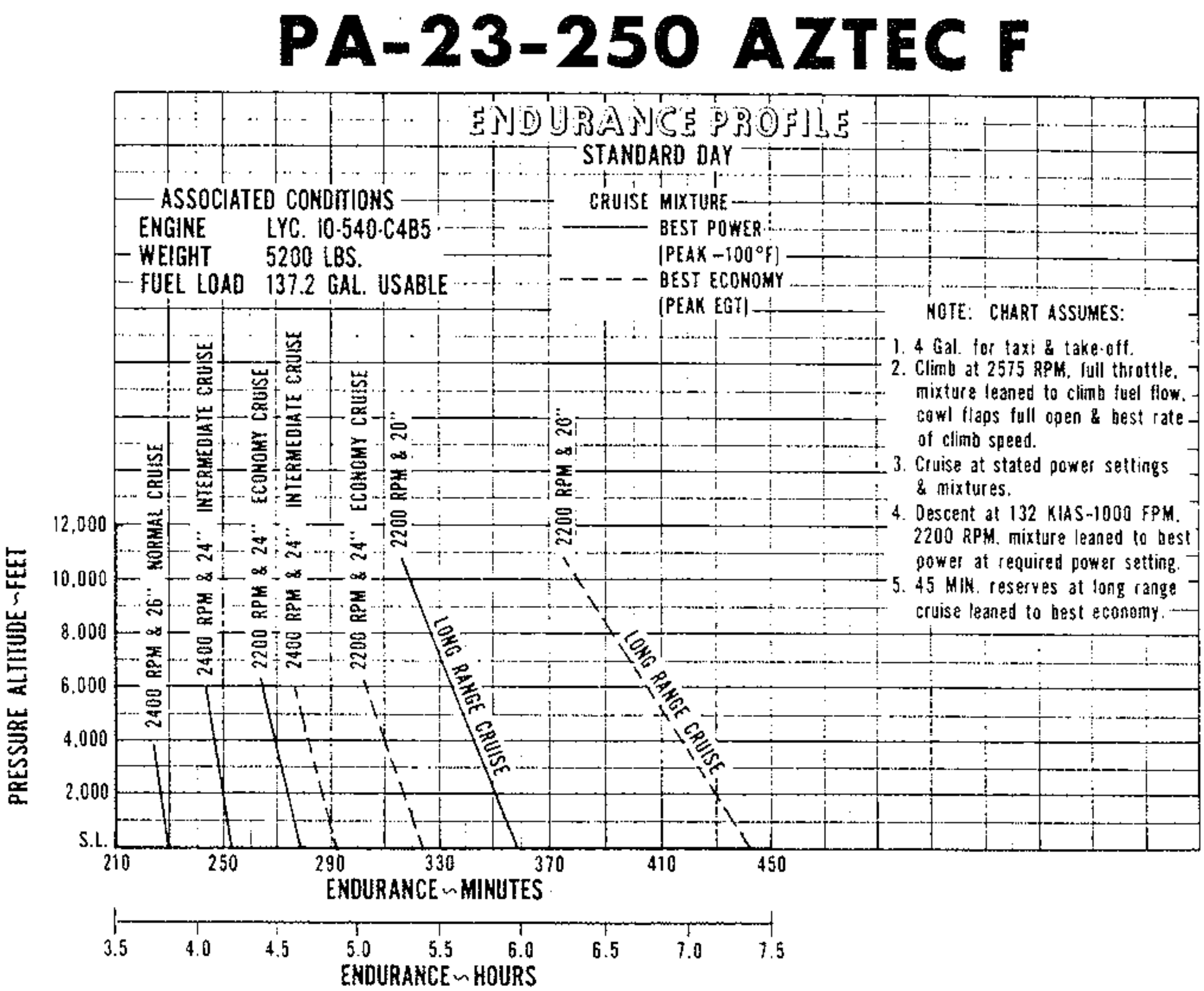
ENDURANCE PROFILE

Figure 5-69



ENDURANCE PROFILE (OPTIONAL TIP TANKS)

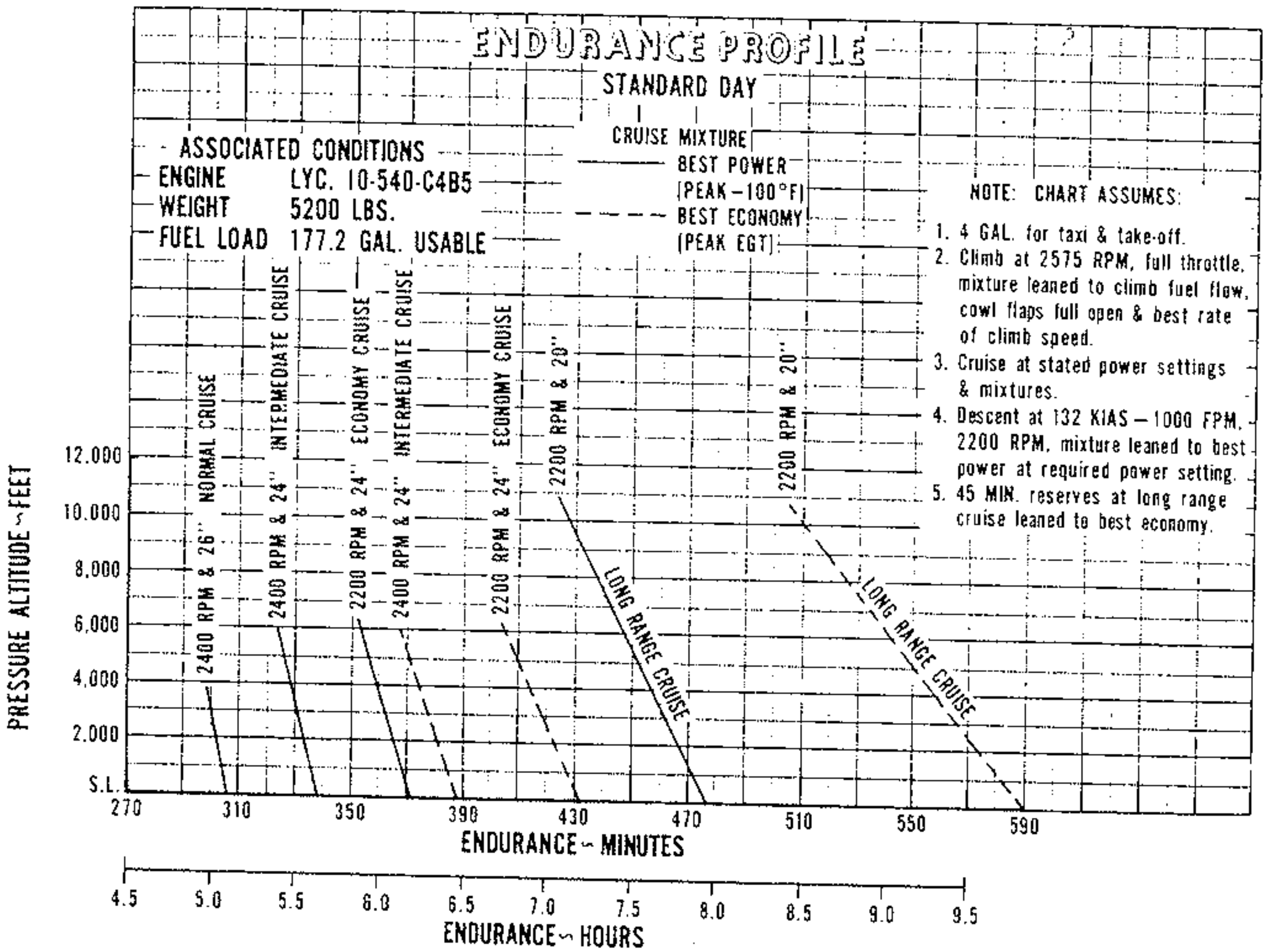
Figure 5-71



ENDURANCE PROFILE

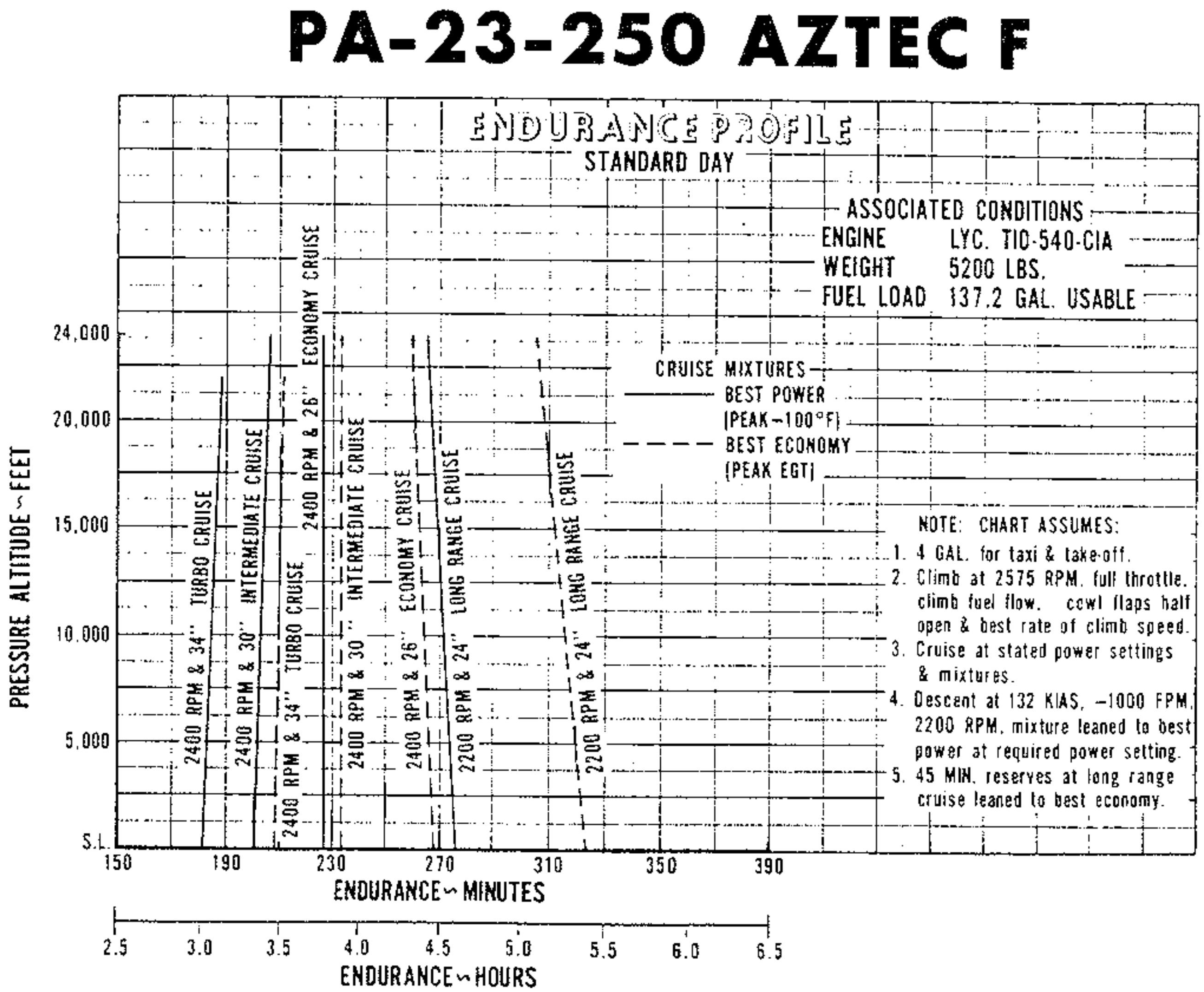
Figure 5-69

PA-23-250 AZTEC F



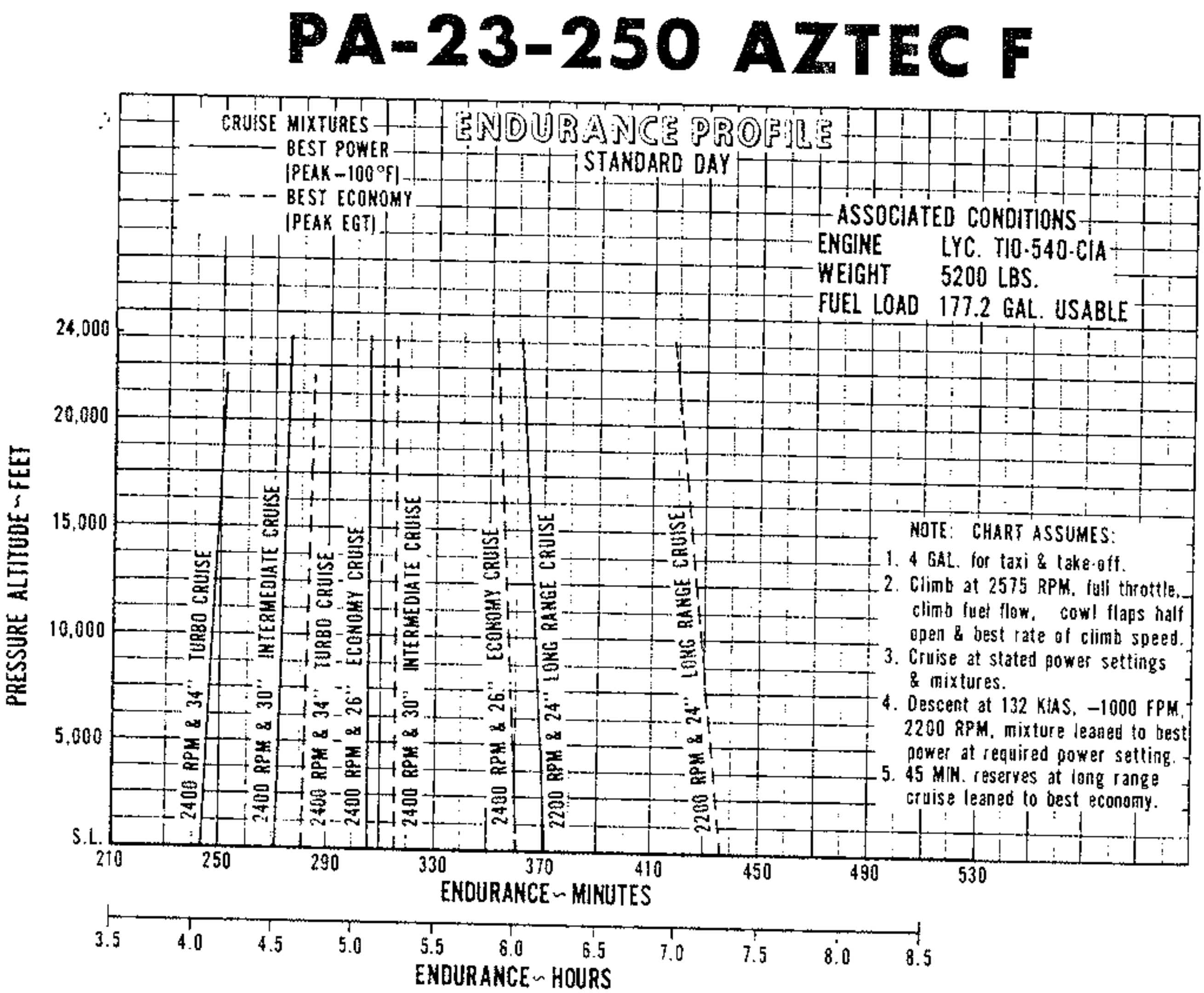
ENDURANCE PROFILE (OPTIONAL TIP TANKS)

Figure 5-71

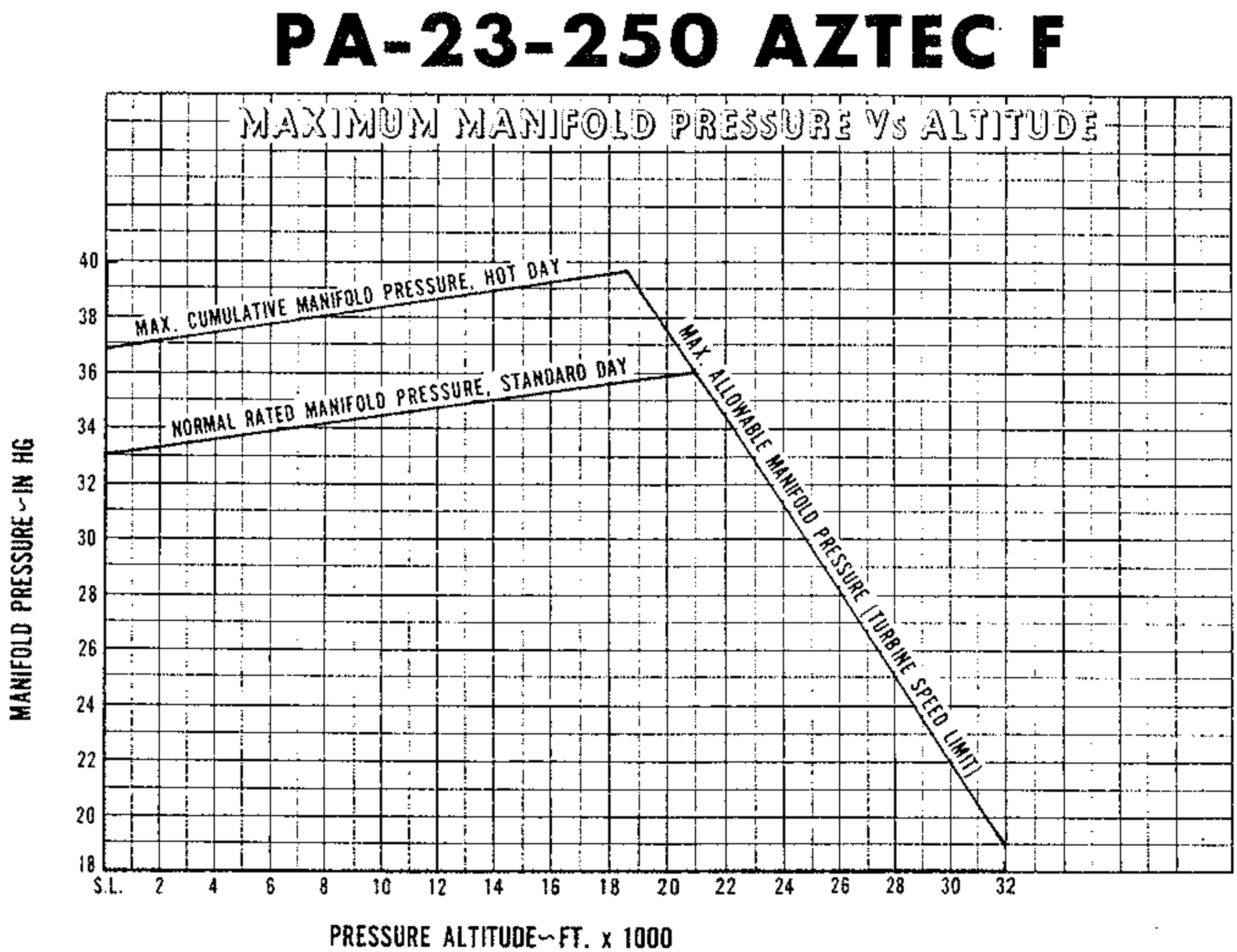


ENDURANCE PROFILE (TURBO)

Figure 5-73

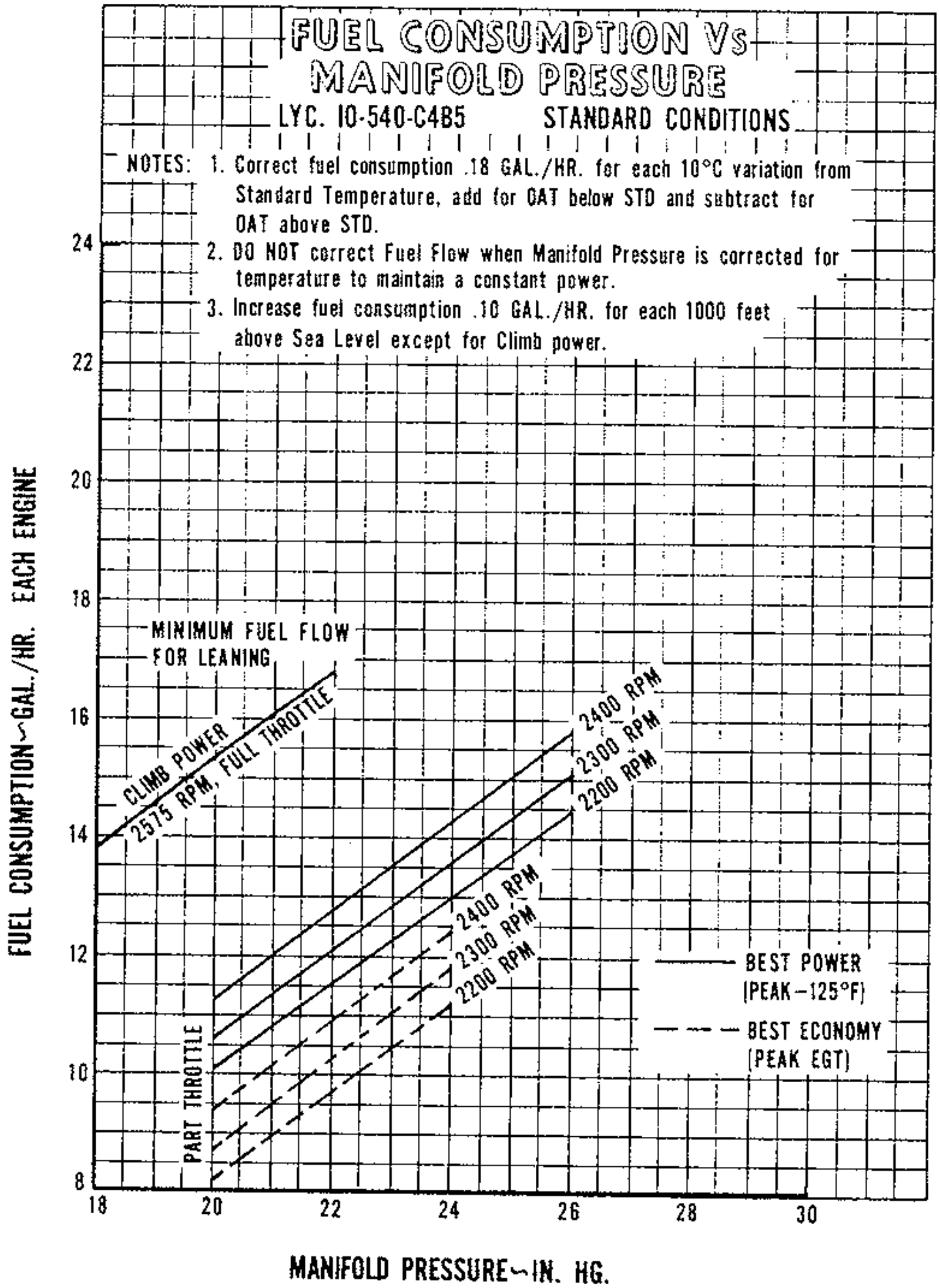


ENDURANCE PROFILE (TURBO - OPTIONAL TIP TANKS)
Figure 5-75



MAXIMUM MANIFOLD PRESSURE VS. ALTITUDE (TURBO)
Figure 5-77

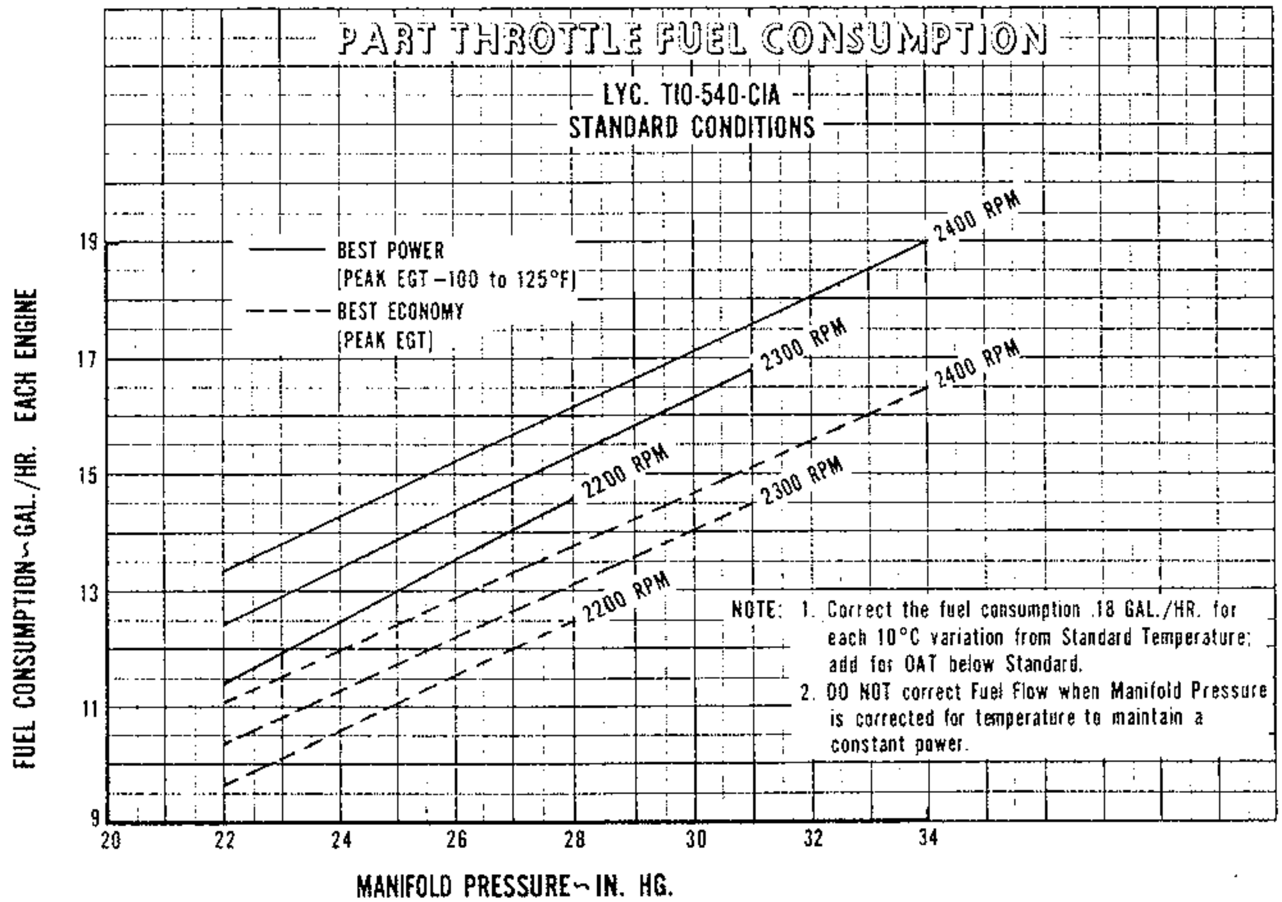
PA-23-250 AZTEC F



FUEL CONSUMPTION VS. MANIFOLD PRESSURE

Figure 5-79

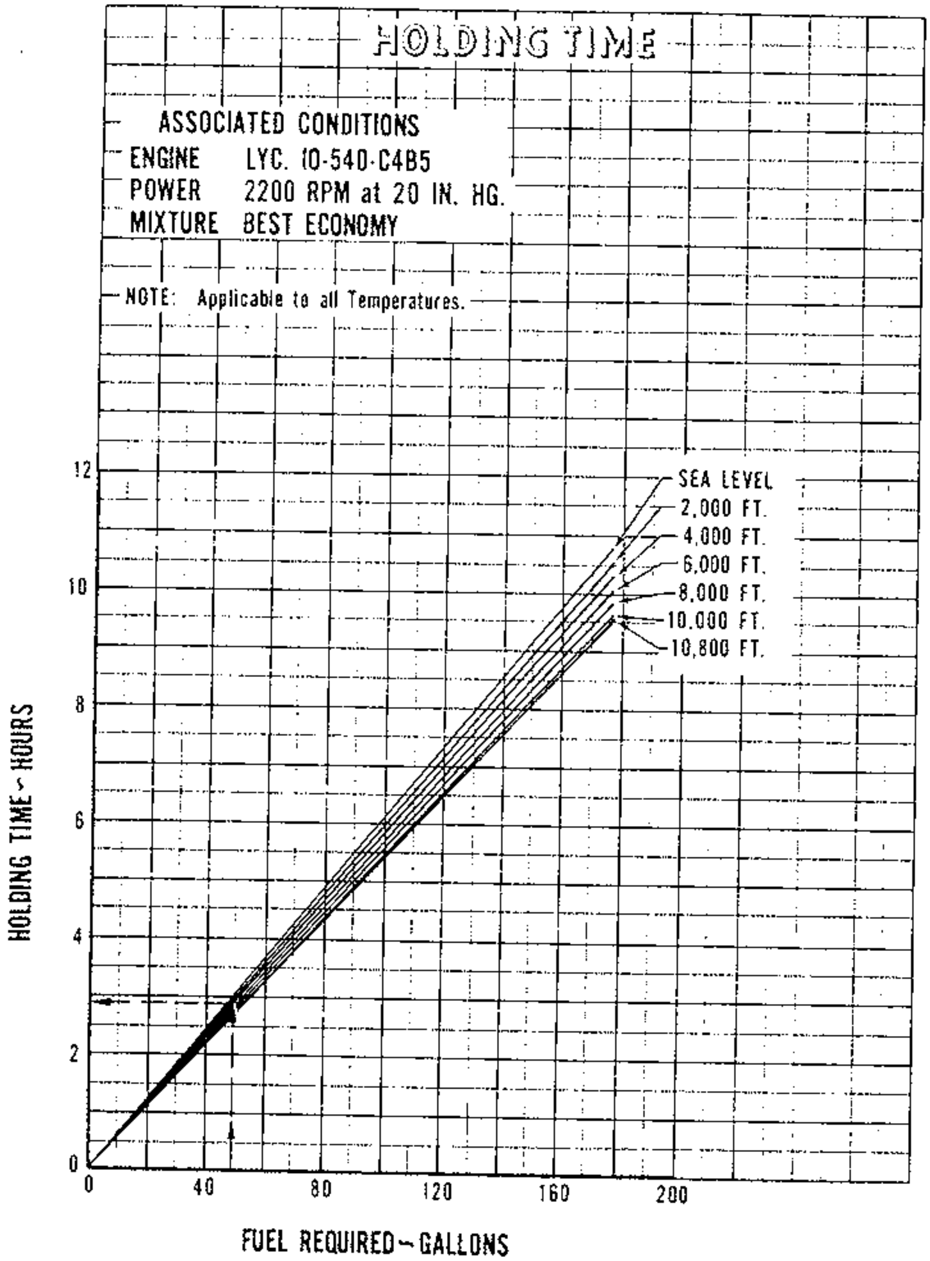
PA-23-250 AZTEC F



PART THROTTLE FUEL CONSUMPTION (TURBO)

Figure 5-81

PA-23-250 AZTEC F



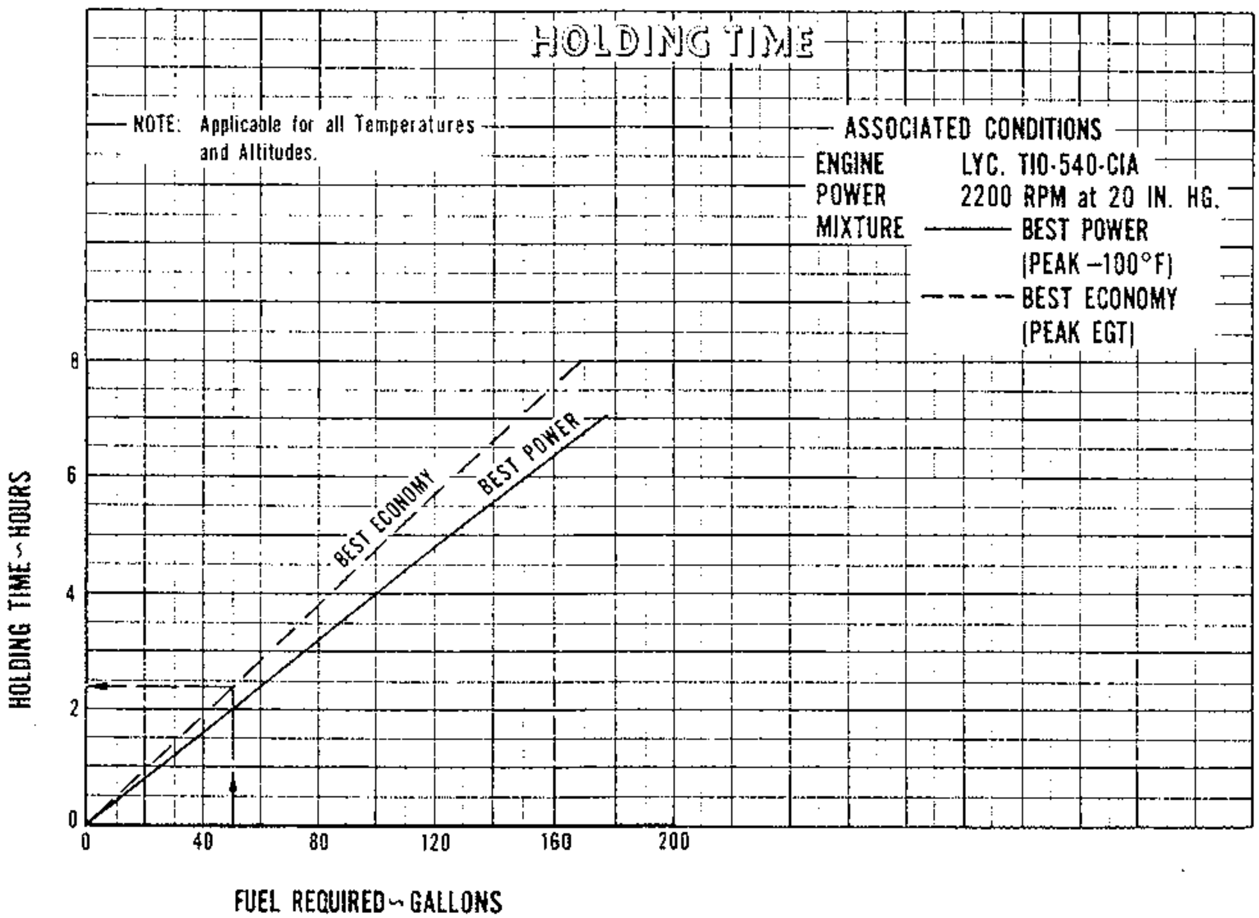
Example:

Fuel available	=	50 gal.
Pressure altitude	=	4000 ft.
Holding time	=	2.9 hours

HOLDING TIME

Figure 5-83

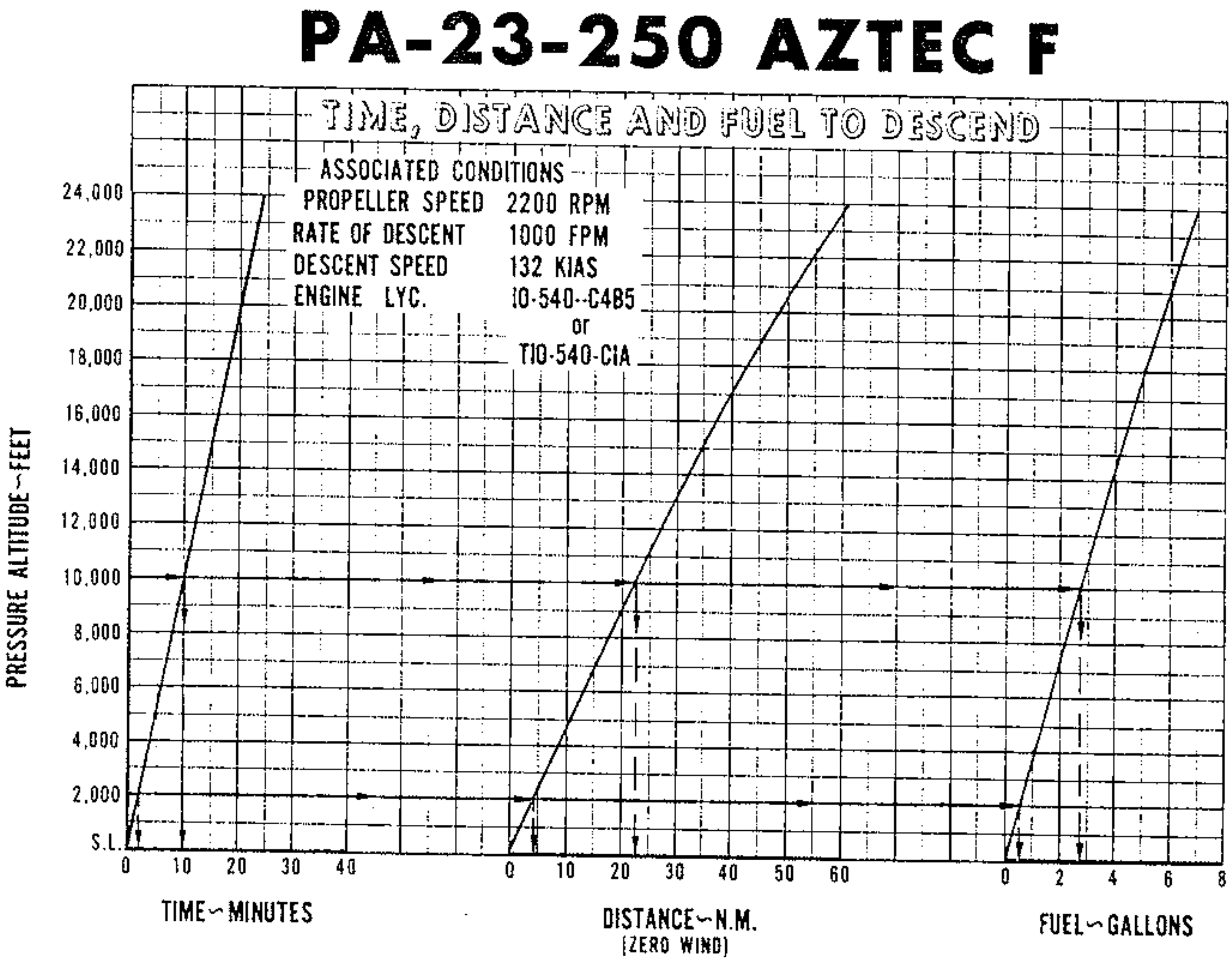
PA-23-250 AZTEC F



Example:
Fuel available = 50 gal.
Mixture Best economy
Holding time = 2.4 hours

HOLDING TIME (TURBO)

Figure 5-85



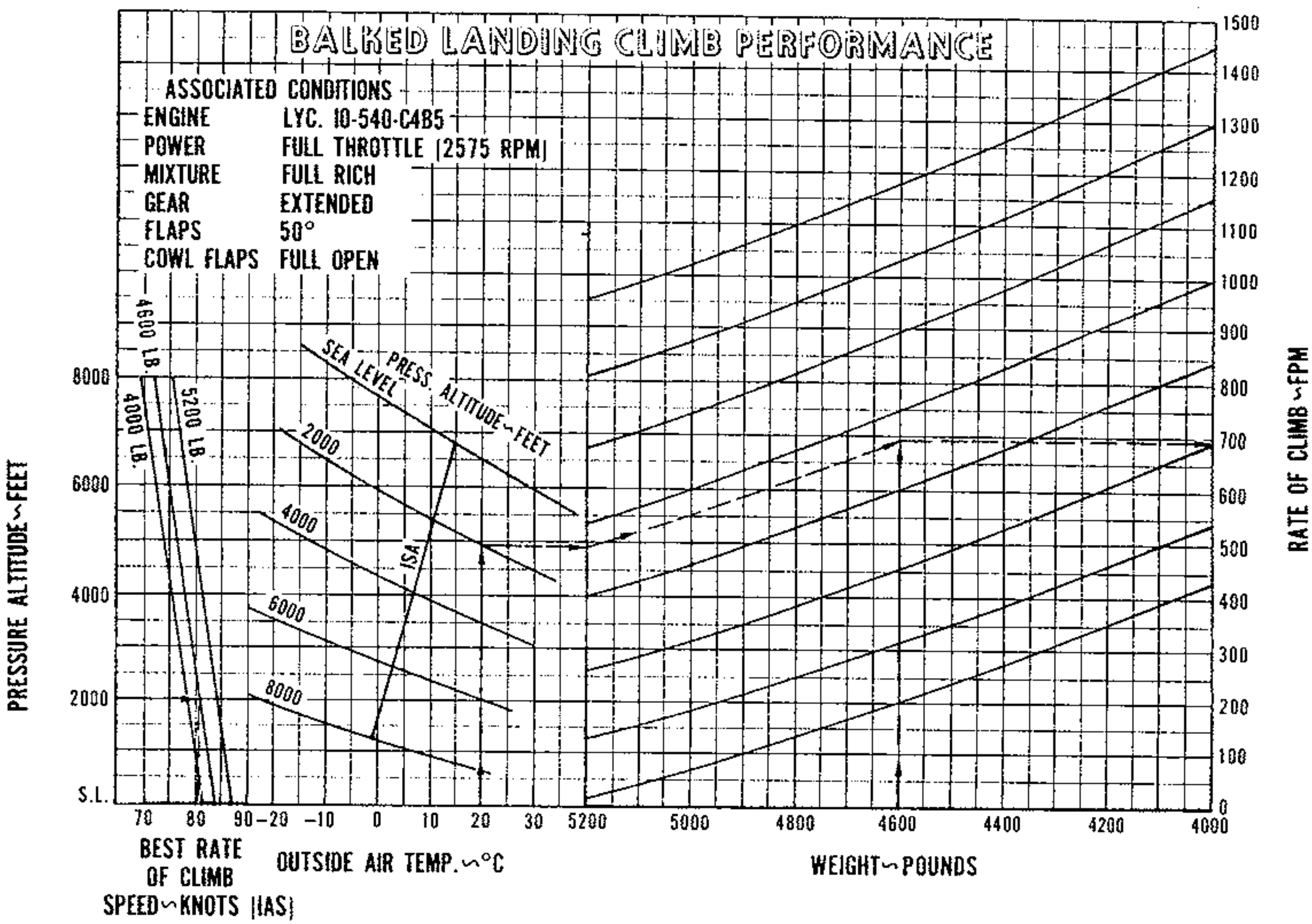
Example:

Airport altitude	=	2000 ft.
Cruise altitude	=	10000 ft.
Time to descend = 10 - 2	=	8 min.
Distance to descend = 22.5 - 4.5	=	18 naut. mi.
Fuel to descend = 2.7 - 0.5	=	2.2 gal.

TIME, FUEL AND DISTANCE TO DESCEND

Figure 5-87

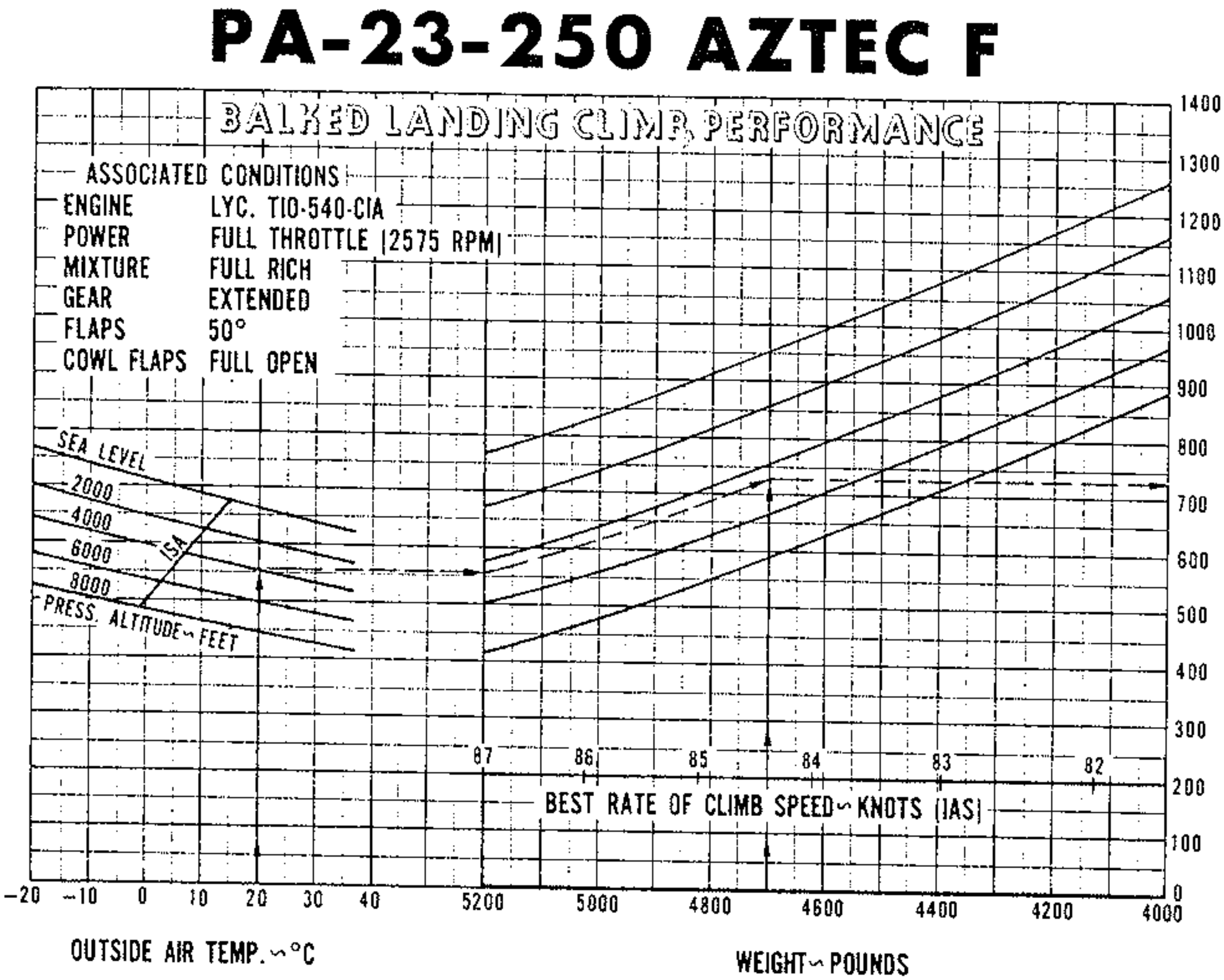
PA-23-250 AZTEC F



BALKED LANDING CLIMB PERFORMANCE
Figure 5-89

Example:

OAT	=	20° C	Rate of climb	=	690 FPM
Pressure altitude	=	2000 ft.	Climb speed	=	80 KIAS
Weight	=	4600 lbs.			



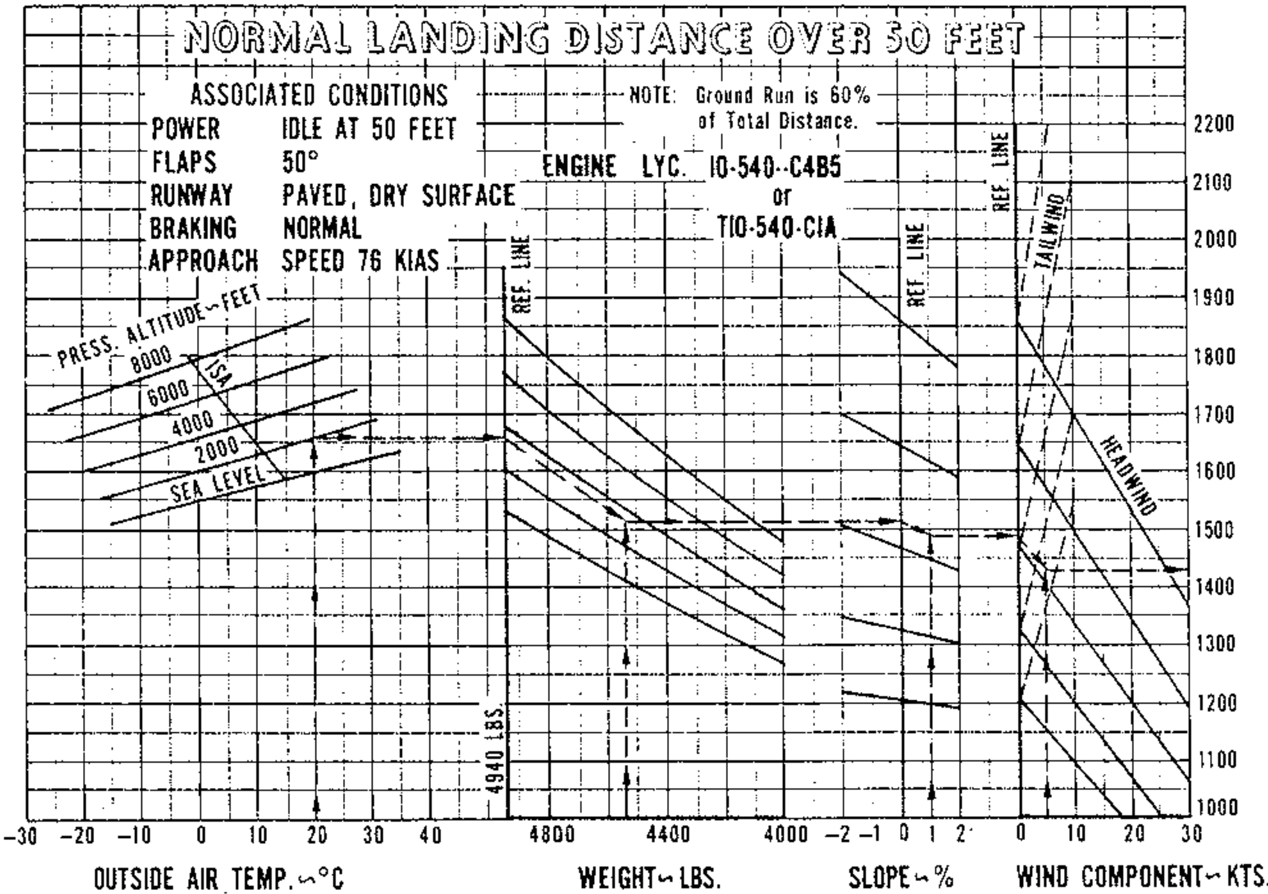
Example:

OAT	=	20° C
Pressure altitude	=	4000 ft.
Weight	=	4700 lbs.
Rate of climb	=	730 FPM
Climb speed	=	84 KIAS

BALKED LANDING CLIMB PERFORMANCE (TURBO)

Figure 5-91

PA-23-250 AZTEC F



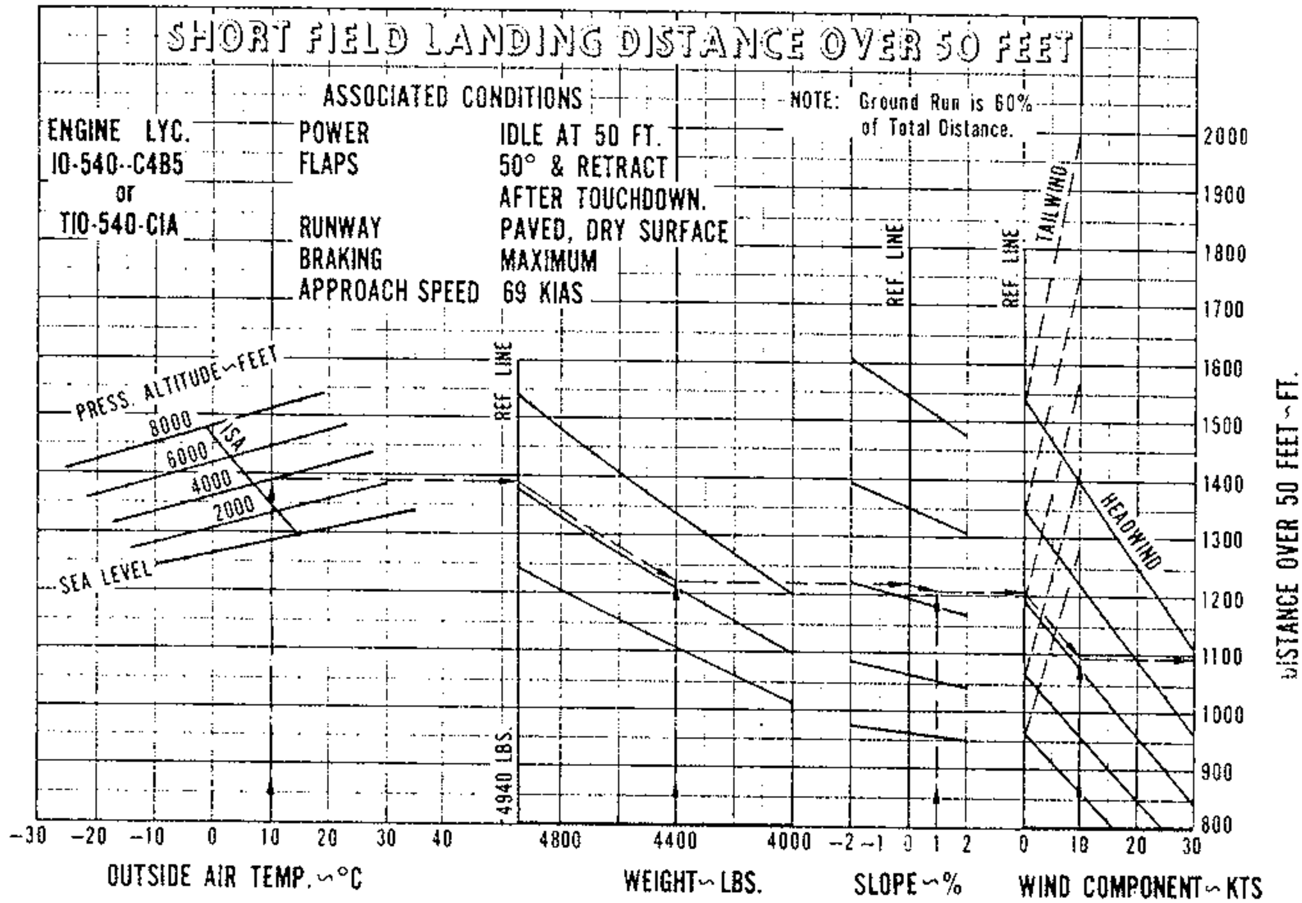
Example:

OAT	=	20° C
Pressure altitude	=	2000 ft.
Weight	=	4540 lbs.
Wind	=	5 kts.
Slope	=	+1.0%
Ground roll	=	860 ft.
Total distance	=	1430 ft.

NORMAL LANDING DISTANCE OVER 50 FEET

Figure 5-93

PA-23-250 AZTEC F



Example:

OAT	=	10° C
Pressure altitude	=	4000 ft.
Weight	=	4400 lbs.
Wind	=	10 kts.
Slope	=	+1.0%
Ground run	=	655 ft.
Total distance	=	1090 ft.

SHORT FIELD LANDING DISTANCE OVER 50 FEET

Figure 5-95

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must insure that the airplane is loaded within the loading envelope before a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however will perform as intended. This airplane is designed to provide performance within the flight envelope. Before the airplane is delivered, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can easily determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-7) and the Weight and Balance Record (Figure 6-9). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against overloading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

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6.3 AIRPLANE WEIGHING PROCEDURES

At the time of delivery, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-7.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops.

(4) Fill to full capacity with oil and operating fluids.

(5) Place pilot and copilot seats in a center position on the seat tracks. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.

(6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing Airplane

With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

AIRPLANE AS WEIGHED
(Including full oil and operating fluids but no fuel)

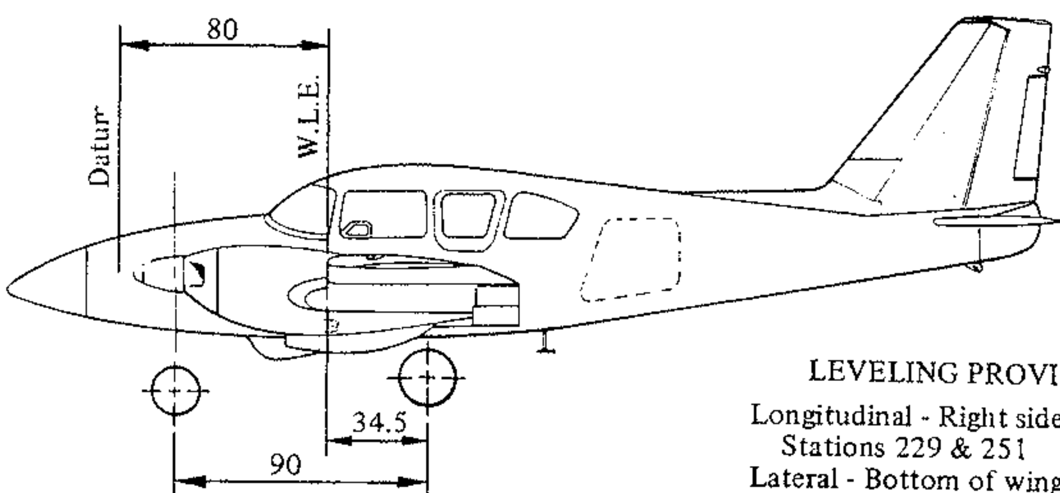
Scale Position and Symbol		Scale Reading	Tare	Net Weight
Nose Wheel	(N)	876		876
Right Main Wheel	(R)	1226		1226
Left Main Wheel	(L)	1237		1237
Weight (as Weighed)	(T)	–	–	3339

WEIGHING FORM

Figure 6-1

(d) Center of Gravity

(1) The following geometry applies to the PA-23-250 (Six Place) airplane when it is level. Refer to Leveling paragraph 6.3 (b).



LEVELING PROVISIONS
Longitudinal - Right side of fuselage Stations 229 & 251
Lateral - Bottom of wing, spar has dihedral of 5°

LEVELING DIAGRAM

Figure 6-3

US Department of Transportation
Federal Aviation Administration

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
OMB No. 2120-0020

For FAA Use Only

Office Identification

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. 1421). Failure to report can result in a civil penalty not to exceed $1,000 for each such violation (Section 901 Federal Aviation Act of 1958).

1. Aircraft	Make PIPER	Model PA-23-250
	Serial No. 27-7954048	Nationality and Registration Mark N62BD
2. Owner	Name (As shown on registration certificate) CTMI	Address (As shown on registration certificate) PO BOX 6431 SPARTANBURG, SC 29304

3. For FAA Use Only

4. Unit Identification				**5. Type**	
Unit	Make	Model	Serial No.	Repair	Alteration
AIRFRAME	(As described in Item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	Type Manufacturer				

6. Conformity Statement

A. Agency's Name and Address	B. Kind of Agency		C. Certificate No.
Avionics America, Inc. 2287 Airport Hwy. Alcoa, TN 37701		U.S. Certificated Mechanic	TC4R539M RADIO CLASS 1-2L3 AF-SS
	X	Foreign Certificated Mechanic	
		Certificated Repair Station	
		Manufacturer	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

Date	Signature of Authorized Individual
7/06/93	John Edwin White 2464946

7. Approval for Return To Service

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is XX APPROVED [ ] REJECTED

BY							
		FAA Flt. Standards Inspector		Manufacturer		Inspection Authorization	Other (Specify)
		FAA Designee	X	Repair Station		Person Approved by Transport Canada Airworthiness Group	

Date of Approval or Rejection	Certificate or Designation No.	Signature of Authorized Individual
7/6/93		John Edwin White 2464946

FAA Form 337 (12-88)

Weight / Balance & Equipment List Revision

LANCASTER AVIONICS, INC. - CRS# LN7R261N
500-U AIRPORT ROAD
LITITZ, PA 17543 Tel: 717-569-1953

A/C Tail # :	N362BP	**A/C Make :**	PIPER
Register Name :	WRIGHT ROBERT G	**A/C Model :**	PA-23-250
Name 2 :		**A/C Serial # :**	27-7954048
Address 1 :	PO BOX 772	**WO Ref # :**	23409
Address 2 :		**WB Date :**	May-09-2019
City, State, PC :	INWOOD, WEST VIRGINIA 25428	**WB ID # :**	915

Previous data taken from document dated Nov-05-1997 Previous useful load = 1868.28

Model # *Serial #*	**Description** *Part #*	(LB / IN) **Weight**	**CG/Arm**	**Moment**
	Previous data ->	3331.72	91.08	303447.22
REMOVED ITEMS ----------				
AK-350	AMERIKING ENCODER	-1.00	43.00	-43.00
FMS-5000	ARNAV LORAN RECEIVER	-2.50	65.50	-163.75
KA-33	KING COOLING FAN	-1.50	55.00	-82.50
KI-227	KING ADF INDICATOR	-0.70	68.50	-47.95
KMA-24	KING AUDIO PANEL	-1.80	66.50	-119.70
KN-64	KING DME RECEIVER *066-01088-0000*	-2.60	65.00	-169.00
KN-72	KING VOR/LOC CONV.	-1.30	34.00	-44.20
KR-87	KING ADF RECEIVER	-3.20	65.00	-208.00
KT-76A	KING TRANSPONDER *066-01062-0000*	-3.10	65.00	-201.50
KX155-31	KING NAV/COM W/GS *069-01024-0031*	-5.30	65.00	-344.50
M-655	DAVTRON ALT/VOLT METER	-0.20	69.00	-13.80
PC-4	TELEX INTERCOM	-0.60	67.00	-40.20
RS08-001	NAT SWITCHING UNIT	-0.40	61.00	-24.40
WX-900 DISPLAY	BFG S.SCOPE DISPLAY	-1.60	66.00	-105.60
REMOVED SUB TOTAL	14 Items @	-25.80	62.33	-1608.10
INSTALLED ITEMS ----------				
013-00112-00	GARMIN SPLITTER	0.20	65.00	13.00
CI-122 *596981*	COMANT VHF ANTENNA	0.60	156.00	93.60
FLIGHTSTREAM 210 *3RE007859*	GARMIN BLUETOOTH INTERFACE	0.40	67.00	26.80
GA-35 *161889*	GARMIN GPS WAAS ANTENNA	0.30	98.00	29.40
GAE-12 *3T6010721*	GARMIN ENCODER	0.10	61.00	6.10
GMA-350 *1UF006625*	GARMIN AUDIO PANEL	2.60	67.00	174.20
GTN-750 *1ZA025513*	GARMIN GPS/NAV/COM *011-02282-00*	9.30	65.50	609.15
GTX-345 *3EG026686*	GARMIN TRANSPONDER	3.20	66.00	211.20
INSTALLED SUB TOTAL	8 Items @	16.70	69.67	1163.45
NEW DATA >>	NEW USEFUL LOAD = 1877.38	3322.62	91.19	303002.57

Authorized Individual : Todd Adams

U.S. Department of Transportation
Federal Aviation Administration

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved OMB No. 2120-0020 11/30/2007

Electronic Tracking Number

For FAA Use Only

INSTRUCTIONS: Print or type all entries. See Title 14 CFR §43.9, Part 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. §44701). Failure to report can result in a civil penalty for each such violation. (49 U. S. C. §46301(a))

1. Aircraft	Nationality and Registration Mark N362BP	Serial No. 27-7954048	
	Make PIPER	Model PA-23-250	Series
2. Owner	Name (As shown on registration certificate) WRIGHT ROBERT G	Address (As shown on registration certificate) PO BOX 772 INWOOD, WEST VIRGINIA 25428 USA	

3. For FAA Use Only

4. Type		5. Unit Identification			
Repair	Alteration	Unit	Make	Model	Serial No.
☐	☒	AIRFRAME	—	*(As described in Item 1 above)*	—
☐	☐	POWERPLANT			
☐	☐	PROPELLER			
☐	☐	APPLIANCE	Type Manufacturer		

6. Conformity Statement

A. Agency's Name and Address	B. Kind of Agency		
LANCASTER AVIONICS, INC. 500-U AIRPORT ROAD LITITZ, PA 17543		U. S. Certificated Mechanic	Manufacturer
		Foreign Certificated Mechanic	C. Certificate No.
	X	Certificated Repair Station	LN7R261N
		Certificated Maintenance Organization	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 5 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U. S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

Extended range fuel per 14 CFR Part 43 App. B ☐	Signature/Date of Authorized Individual Mark J. Forth 10-May-2019

7. Approval for Return to Service

Pursuant to the authority given persons specified below, the unit identified in item 5 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ Approved ☐ Rejected

BY		FAA Flt. Standards Inspector		Manufacturer		Maintenance Organization		Persons Approved by Canadian Department of Transport
		FAA Designee	X	Repair Station		Inspection Authorization	Other (Specify)	

Certificate or Designation No. LN7R261N	Signature/Date of Authorized Individual Todd M. Adams 10-May-2019

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. Description of Work Accomplished
(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

Nationality and Registration Mark	Date
N362BP	May-10-2019

The following equipment was removed: Ak350 Encoder, FMS5000 GPS, KA33 Cooling Fan, KR87 ADF w/KI227, KMA24 Audio Panel, KN64 DME, KX155 w/KN72, KT76A Transponder, M655 Volt Meter, PC-4 Intercom, WX900 Display, and RS08 Relay.

The following equipment was installed: Garmin GTN750 GPS/Nav/Com w/GA35, Flightstream 210, Garmin GAE12 Encoder, Garmin GMA350 Audio Panel, Ci122 Com Antenna, and Garmin GTX345 Transponder.

GMA350 & CI122 were installed IAW AC43.13-1B/-2B Chapters 2 & 3 and appropriate manufacturer's installation manuals.

Installed Garmin GTN750 System IAW Garmin STC# SA02019SE-D and Garmin GTN7xx/6xx Series Installation Manual p/n 190-01007-A3 Rev 2 per TSO-C146a:
1) Installed GTN750 in location determined to be within within the prescribed "Acceptable View" therefore further annunciation is not required.
2) Verified all interfaces to be in compliance with the Garmin GTN7xx/6xx Series Installation Manual p/n 190-01007-A3 Rev 2 per TSO-C146a and operating as intended.
3) Inserted Garmin supplied Instructions for Continued Airworthiness p/n190-01007-A3 Rev x in the aircraft records.
4) Inserted Garmin supplied Flight Manual Supplement p/n 190-01007-A2 Rev x in the POH.

Installed Garmin GTX345 Transponder w/GAE12 Encoder, & Flightstream 210 IAW STC# SA01714WI. Inserted GTX345/ADS-B Flight Manual Supplement in POH. COMPLIED WITH FAR 91.411 AND FAR 43, APPENDIX E ALT./ENC./STATIC SYS CERT. COMPLIED WITH FAR 91.413 AND FAR 43, APPENDIX F 2YR TRANSPONDER CERT. TESTED GARMIN GTX345 TRANSPONDER FOR ADS-B COMPLIANCE. SYSTEM WAS FOUND TO COMPLY WITH AC20-165 and 14 CFR 91.225 & 91.227.

All wiring/cabling used for installation purposes meets or exceeds the following specifications: (M17/29, and/or M17/60) - coax; (M22759, M27500, and/or M81044) - wire. All circuit breakers used for installation purposes were of the Klixon, Potter/Brumfield, and/or Mechanical Products variety.

All of the above installed equipment was functionally tested and was found to perform its intended function with no adverse effects on other aircraft systems.

Weight and Balance change recalculated. Equipment list revised.

--END--

☐ ADDITIONAL SHEETS ARE ATTACHED

EQUIPMENT LIST SUPPLEMENT
WEIGHT AND BALANCE DATA

Date:	11/5/97
Aircraft Registration:	N362BP
Aircraft Make and Model:	Piper PA23-250
Aircraft Serial Number:	27-7954048

DESCRIPTION	PART #	WEIGHT	ARM	MOMENT
Previous Weight and Balance		3,332.35	91.07	303,464.55
REMOVED:				
Metal RH Spinner Bulkhead	23815-00	-1.50	27.50	-41.25
INSTALLED:				
Composite RH Spinner Bulkhead	TCB23815-00	0.87	27.50	23.92
TOTAL		3,331.72	90.94	303,447.22

GROSS WEIGHT:	5,200.00
NEW AIRCRAFT EMPTY WEIGHT:	3,331.72
NEW AIRCRAFT USEFUL LOAD:	1,868.28
NEW AIRCRAFT CG:	~~90.94~~ 91.08
NEW AIRCRAFT MOMENT:	303,447.22

REVISED 5/9/19

DATED: 7/6/1993

N362BP
S/N # 27-7954048

Revised equipment list and computed weight and balance. Equipment function test and found to comply with FAR. 23.1301 & 23.1301-1A.
Made log book entry.
Details on work order 7133.

----------------------------END----------------------------

REVISED WEIGHT & BALANCE DATE

GROSS WEIGHT:	5,200.00
NEW AIRCRAFT EMPTY WEIGHT:	3,332.35
NEW AIRCRAFT USEFUL LOAD:	1,867.65
NEW AIRCRAFT C.G.:	91.07
MOMENT:	303,464.55

~~NEW USE THIS~~

Superseded 11/05/97

-769-012/6015

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. Description of Work Accomplished

(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

INSTALLED:

1) WX 900 STORMSCOPE DISPLAY p/n # 78-8060-5960-2 s/n # FNP04301844 in left instrument panel of aircraft at station 54.0" aft.

2) WX 900 STORMSCOPE ANTENNA p/n # 78-8060-5970-1 s/n # FNA03301783 aft bottom fuselage at station 198.0" aft.

3) RC ALLEN ELECTRIC ATTITUDE GYRO p/n # RCA26BK-6 s/n # 93F2136 in right instrument panel at station 56.0" aft.

4) UNITED 20000 FT. ALTIMETER p/n # 5934P-1 s/n # 3J780 in right instrument panel at station 57.0" aft.

All work and installation performed per Foster Stormscope Series II WX-900 installation manual dated 10/92 Figure 2-6 and 2-7 Systems Interconnect pages 2-18 and 2-19. Equipment function test per manufactures speces and found to comply. Aircraft skin mapped to provide maximum equipment performance per M.P.S.

AIRCRAFT SYSTEM TEST FOR ELECTRO MAGNETIC INTERFERENCE (EMI) AND NO TEST INDICATES ANY TYPE OF EMI.

Installation complies with AC 43.13-1A chapter 5, section 1, para 227, 228, 230, 231, 232, 233, chapter 11 section 1, para 406, 407 408, 409, 410, 411, section 2 para 424, 428, 429, 430, section 3 para 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, section 4 para 466, section 5 para 478, 479, 480, section 7 para 514 thru 519 and AC 43.13-2A chapter 1 para 1 thru 12, chapter 2 para 21 thru 27, chapter 3 para 36 thru 42 and chapter 11 para 211 thru 214. All equipment installed in accordance with manufacturers installation manuals and instructions.

Performed static leak test per FAR 43, appendix E paragraph A & C, I. A. W. 91.411, and found to comply.

☑ Additional Sheets Are Attached

AVIONICS AMERICA INC. 2287 AIRPORT HWY. ALCOA, TN. CRS TC4R539M
PHONE: 615-970-9999

EQUIPMENT LIST SUPPLEMENT
WEIGHT & BALANCE DATA

AIRCRAFT OWNER: CTMI
AIRCRAFT REGISTRATION: N362BP
AIRCRAFT MAKE AND MODEL: PIPER PA-23-250
AIRCRAFT SERIAL NUMBER: 27-7954048

EQUIPMENT DESCRIPTION	PART #	SERIAL #	WEIGHT	ARM	MOMENT
PREVIOUS WEIGHT & BALANCE:			3,32[illegible]5	91.10	302,994.05
WORK ORDER # 7133.					0.00
TACK TIME: 449.0					0.00
					0.00
					0.00
INSTALLED:					0.00
RC ALLEN ELECTRIC ALTITUDE GYRO	RCA26BK-6	93F2136	2.30	56.00	128.80
UNITED 20'000 FT. ALTIMETER	5934P-1	3J780	1.70	57.00	96.90
BF GOODRICH WX 900					0.00
STORMSCOPE DISPLAY	78-8060-5960-2	FNP04301844	1.60	54.00	86.40
B F GOODRICH WX 900					0.00
STORMSCOPE ANTENNA	78-8060-5970-1	FNA03301783	0.80	198.00	158.40
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
					0.00
TOTAL			3,332.35	91.07	303,464.55

GROSS WEIGHT	5,200.00
NEW AIRCRAFT EMPTY WEIGHT	3,332.35
NEW AIRCRAFT USEFUL LOAD	1,867.65
NEW AIRCRAFT C.G.	91.07
MOMENT	303,464.55

Superseded
11/05/97

(2) C.G. Arm of airplane as weighed =

$$(80 + 34.5) - \frac{(90)\ \overset{876}{(N)}}{\underset{3339}{T}} = 90.9$$

Inches Aft of Datum

(e) Basic Empty Weight

Item	Weight (Lbs)	x Arm (Inches Aft of Datum)	= Moment (In-Lbs)
Weight (as Weighed)	3339	90.9	303515
Unusable Fuel (6.8 gal.)	41	113	4633
Basic Empty Weight	3380	91.2	308148

BASIC EMPTY WEIGHT

Figure 6-5

FROM FACTORY

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-7 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from the factory has been entered in the Weight and Balance Record (Figure 6-9). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

PA-23-250 (Six Place)			Serial Number	Registration Number					Page Number		
Date	Item No.		Description of Article or Modification	Weight Change						Running Basic Empty Weight	
				Added (+)			Removed (-)				
	In	Out		Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
			As Delivered								

WEIGHT AND BALANCE RECORD

Figure 6-9

PA-23-250 (Six Place)			Serial Number	Registration Number					Page Number		
Date	Item No.		Description of Article or Modification	Weight Change						Running Basic Empty Weight	
				Added (+)			Removed (-)				
	In	Out		Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
			As Delivered								

WEIGHT AND BALANCE RECORD (cont)

Figure 6-9 (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

Load occupants from front to rear progressively and observe zero fuel weight limitations.

(a) Pilot Only
Load rear baggage compartment to capacity first.

(b) 2 Occupants - Pilot and passenger in front.
Load rear baggage compartment to capacity first. Baggage in nose limited by envelope with full fuel.

(c) 3 Occupants - 2 in front, 1 in middle.
Load rear baggage compartment to capacity first. Baggage in nose limited by envelope with full fuel.

(d) 4 Occupants - 2 in front, 2 in middle.
Load rear baggage compartment to capacity first. Baggage in nose limited by envelope with full fuel.

(e) 5 Occupants - 2 in front, 2 in middle, 1 in rear.
Forward and rearward baggage limited by envelope with full fuel. With 2 full tanks of fuel, load rear baggage compartment first.

(f) 5 Occupants - 1 in front, 2 in middle, 2 in rear.
Permitted only with special loading investigation.

(g) 6 Occupants - 2 in front, 2 in middle, 2 in rear.
6 occupants permitted only with limited fuel or baggage. Load forward baggage compartment to capacity first.

NOTE

These general loading recommendations suggest normal proper loading procedures. The charts, graphs, instructions, and plotter should be checked to assure that the airplane is within the allowable weight vs. center of gravity envelope.

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the Basic Empty Weight.

(b) Use the Loading Chart (Figure 6-15) to determine the moment of all items to be carried in the airplane.

(c) Add the moment of all items to be loaded to the Basic Empty Weight moment.

(d) Divide the total moment by the total weight to determine the C.G. location.

(e) By using the figures of item (a) and item (d) (above), locate a point on the Weight, Moment and C.G. Limits graph (Figure 6-17). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

(f) Location of the point on the Weight, Moment, and C.G. Limits graph indicates whether the airplane is slightly nose heavy or slightly tail heavy and can assist in setting pitch trim for takeoff.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

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ITEM	WT. LBS.	ARM-IN.	MOMENT
Basic Airplane			
Revised Airplane			
Pilot's Seat		89	
Copilot's Seat		89	
Seat No. 3		126	
Seat No. 4		126	
Seat No. 5		157	
Seat No. 6		157	
Fuel___Gal. Inbrd.		113	
Fuel___Gal. Otbrd.		See Table (Fig. 6-15)	
Fwd. Baggage		10	
Rwd. Baggage		183	
Total Wt.		Total Moment	

C.G. Location for Takeoff

WORK SHEET

Figure 6-13

ITEM	WT. LBS.	ARM-IN.	MOMENT
Basic Airplane	3090	90.9	280881
Revised Airplane			
Pilot's Seat	170	89	15130
Copilot's Seat	170	89	15130
Seat No. 3	170	126	21420
Seat No. 4	170	126	21420
Seat No. 5		157	
Seat No. 6		157	
Fuel 68.4 Gal. Inbrd.	410	113	46330
Fuel 60 Gal. Otbrd. *	360	See Table (Fig. 6-15)	40680
Fwd. Baggage	150	10	1500
Rwd. Baggage	150	183	27450
Total Wt.	4840	Total Moment	46994

C.G. Location for Takeoff 97.1

*Example assumes standard outboard tanks without optional tip tanks installed.

SAMPLE LOADING PROBLEM

Figure 6-11

OCCUPANTS

Weight	Pilot Copilot Arm 89	Center Seat Arm 126	Aft Seat Arm 157
	Moment/100		
120	107	151	188
130	116	164	204
140	125	176	220
150	134	189	236
160	142	202	251
170	151	214	267
180	160	227	283
190	169	239	298
200	178	252	314

BAGGAGE

Weight Lbs.	Forward Arm = 10	Rear Arm =183
	Moment/100	
10	1	18.3
20	2	36.6
30	3	54.9
40	4	73.2
50	5	91.5
60	6	109.8
70	7	128.1
80	8	146.4
90	9	164.7
100	10	183.0
110	11	201.3
120	12	219.6
130	13	237.9
140	14	256.2
150	15	274.5

LOADING CHART

Figure 6-15

FUEL

Gallons	Weight Lbs.	Inboard Tanks Arm = 113 In.	Outboard Tanks Without Optional Tip Tanks Arm = 113 In.
		Moment/100	
5	30	33.9	33.9
10	60	67.8	67.8
15	90	101.7	101.7
20	120	135.6	135.6
25	150	169.5	169.5
30	180	203.4	203.4
34.3	206	232.8	232.8

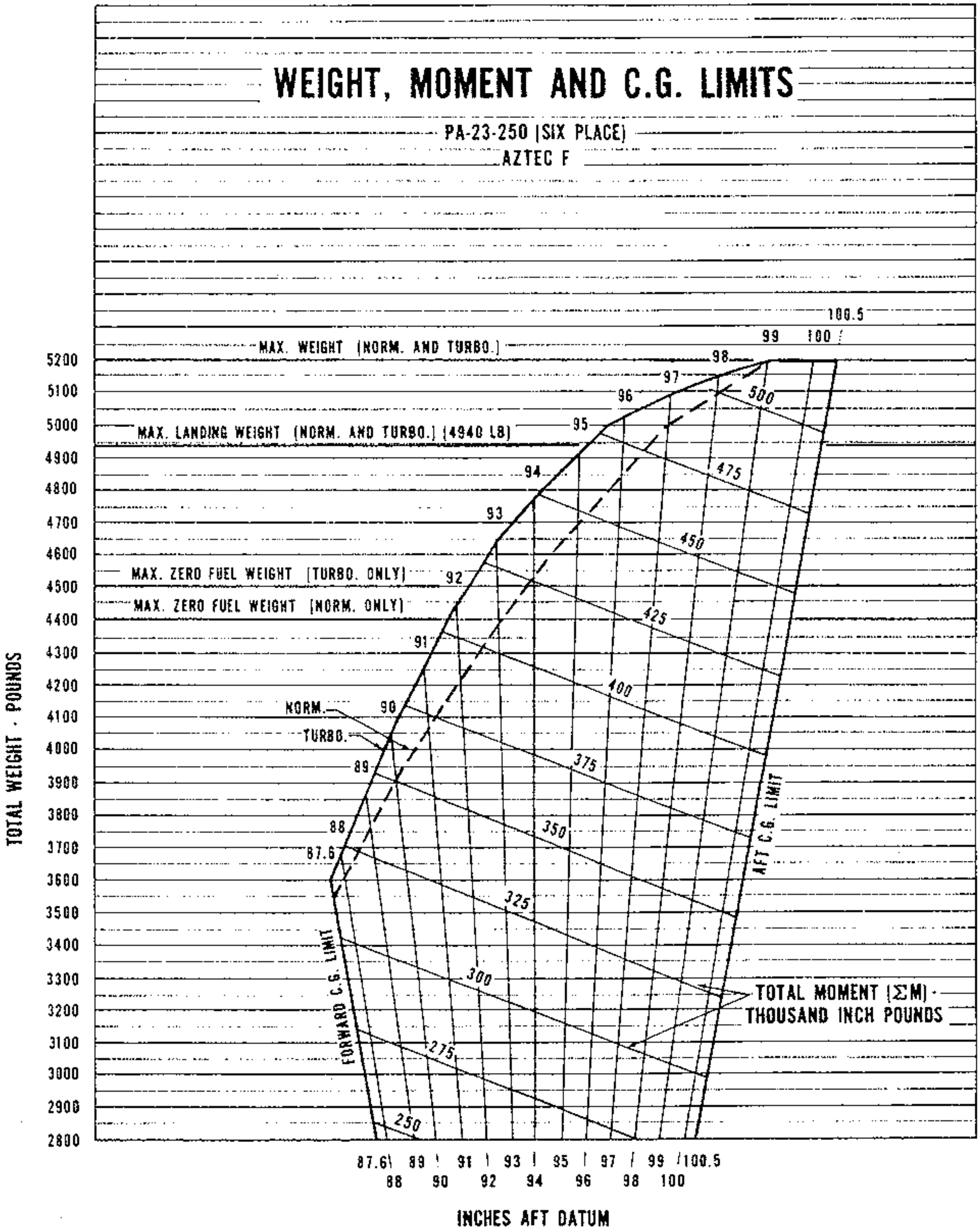
1.7 gal. unusable fuel per tank (10.2 lbs., 1153 in-lbs.) included in basic weight.

Gallons	Weight Lbs.	Outboard Tanks With Optional Tip Tanks (First 25 Gal. at 112.1 In., Remainder at 105.1 In.)
		Moment/100
5	30	33.6
10	60	67.3
15	90	100.9
20	120	134.5
25	150	168.2
30	180	199.7
35	210	231.2
40	240	262.7
45	270	294.3
50	300	325.8
54.3	326	353.1

1.7 gal. unusable fuel per tank (10.2 lbs., 1153 in-lbs.) included in basic weight.

LOADING CHART (cont)

Figure 6-15 (cont)



WEIGHT, MOMENT AND C. G. LIMITS

Figure 6-17

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6.11 WEIGHT AND BALANCE VISUAL PLOTTER

The Weight and Balance Visual Plotter (Figure 6-19) furnished with the airplane will enable the pilot to graphically determine whether or not his proposed loading will fall within the allowable envelope. It will also allow him to easily determine the necessary adjustments to make if his first proposed loading is not within this envelope.

When plotting successive points, the pilot is graphically adding weights and corresponding moments. As the weight increases, through the addition of various items of disposable load, the pilot will see the shift in the center of gravity.

Going clockwise around the envelope, the heavy lines represent allowable weight at the forward C.G. limit (87.6 in.), the maximum allowable weight as the C.G. shifts rearward, the maximum weight with no fuel, the gross weight (5200 lbs.), and the maximum rearward C.G. limit (100.5 in.).

Before arranging his load, the pilot should consult the General Loading Recommendations.

IT IS THE RESPONSIBILITY OF THE OWNER AND PILOT TO ASCERTAIN THAT THE AIRPLANE ALWAYS REMAINS WITHIN THE ALLOWABLE WEIGHT VS. CENTER OF GRAVITY ENVELOPE WHILE IN FLIGHT.

6.13 INSTRUCTION FOR USING PLOTTER

(a) Locate the point on the plotter face corresponding to the "Airplane Weight" and "C.G. Location." This point (1) represents the Basic Empty Weight of the airplane with oil, operating fluids, and 6.8 gallons of unusable fuel included.

(b) Lay the transparent plotter over the envelope with the base or "Zero" line of the "Front Occupants" slot on point 1. Follow the "Front Occupants" slot to the point (2) corresponding with the combined weights of the front seat occupants.

(c) Place the "Zero" line of the "Middle Occupants" slot over point 2, and follow the slot to the point (3) corresponding with the combined weight of the middle seat passengers.

(d) Place the "Zero" line of the "Rear Occupants" slot over point 3, and following the slot to the combined weight of the rear seat passengers, establish point 4.

(e) Place the "Zero" line of the "Rear Baggage" slot over point 4, and establish in the slot a new point (5) corresponding to the rear baggage weight.

(f) Place the "Zero" line of the "Front Baggage" slot on point 5, and at the front baggage compartment weight in the slot, establish point 6.

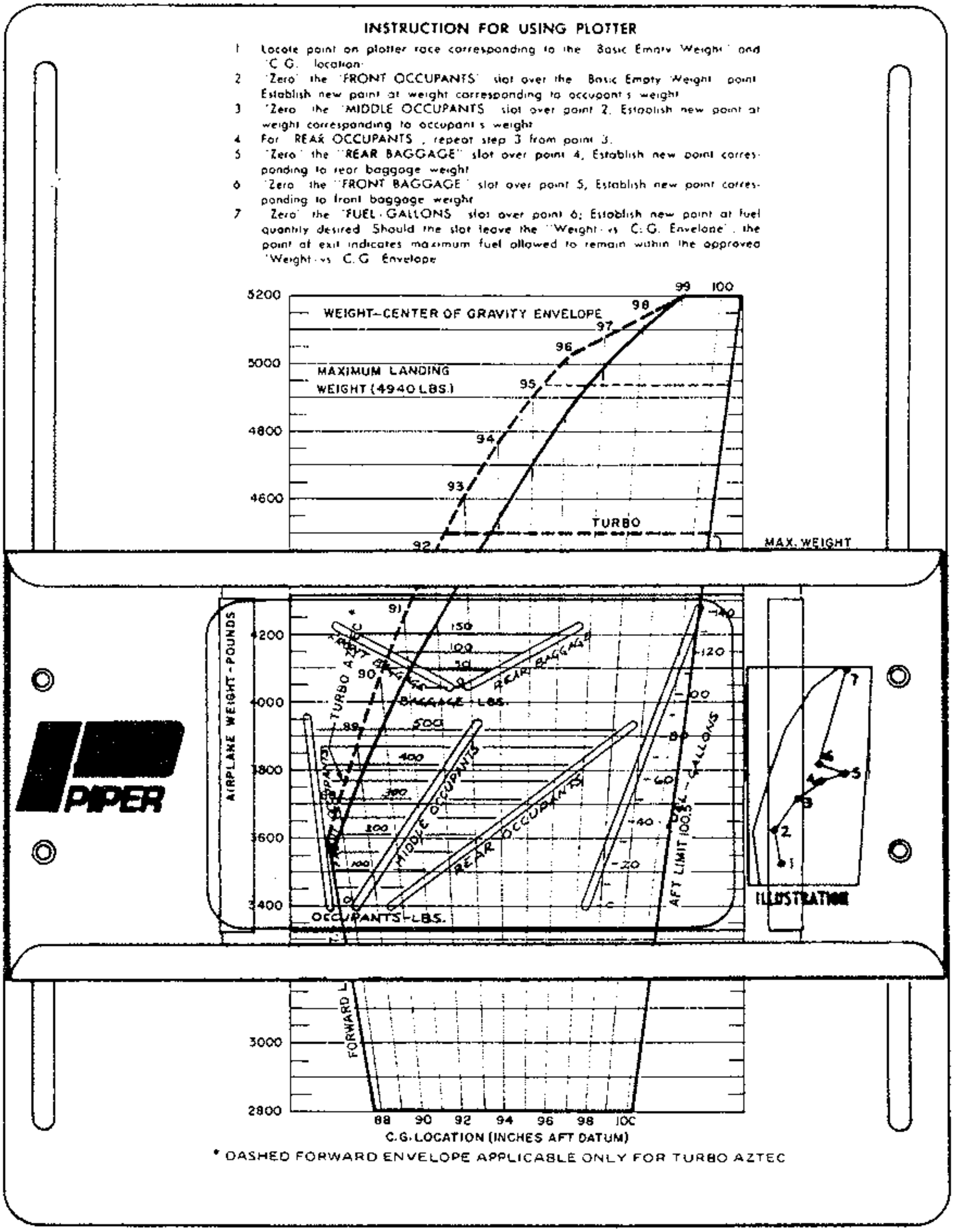
(g) Place the "Zero" line of the "Fuel-Gallons" slot on point 6. Establish a new point (7) in the slot at the fuel quantity desired. Should point 7 fall outside the "Weight - Center of Gravity Envelope," the point at which the slot leaves the envelope indicates the maximum fuel allowed in order to remain within the approved allowable Weight vs. Center of Gravity Envelope.

NOTE

The plotter provided with airplanes having optional wing tip tanks installed has two slots for fuel quantity. Fuel in each tank must be added individually.

NOTE

The pilot is not restricted to adding the items in the same succession as above. When plotting successive items of disposable load, the items most important to the mission under consideration (range or payload) may be added first.



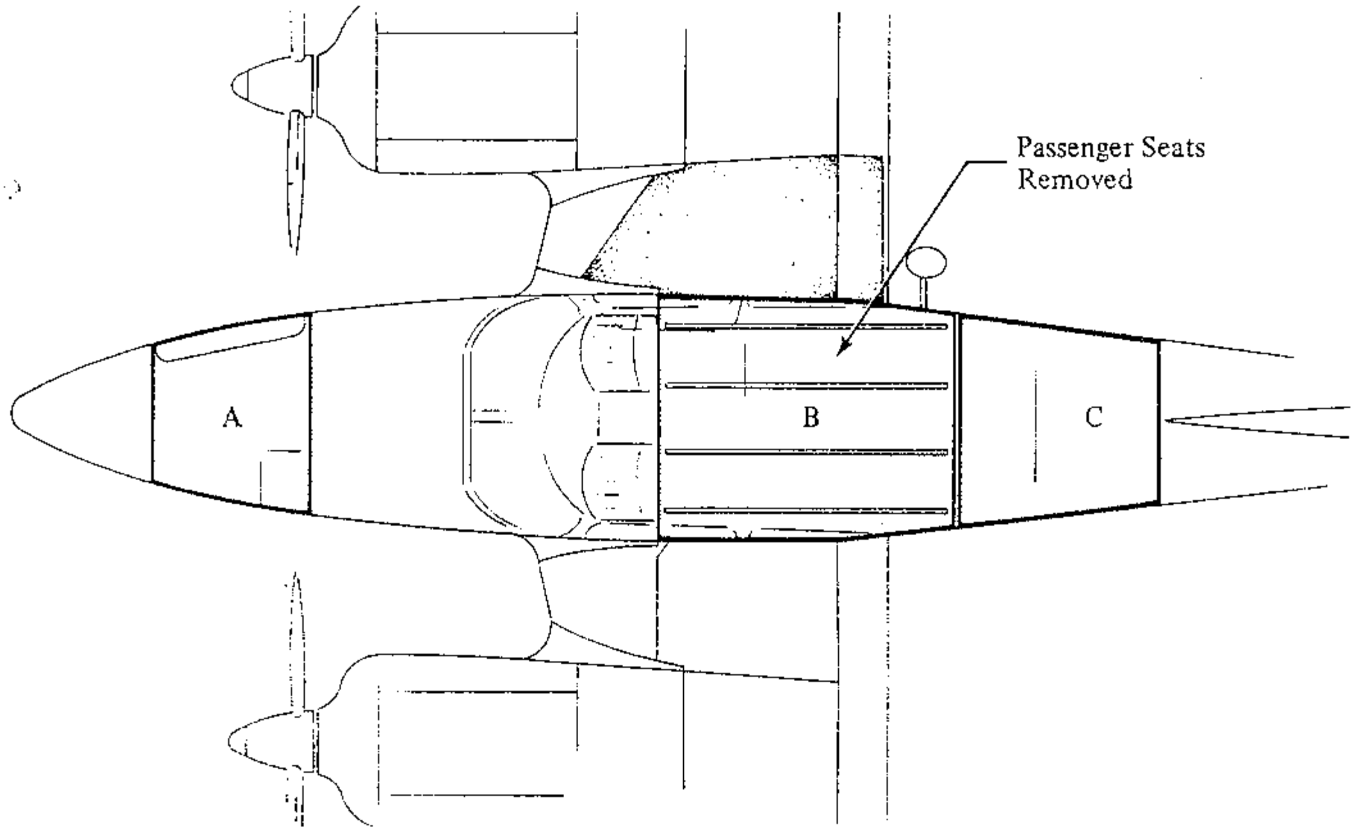
WEIGHT AND BALANCE VISUAL PLOTTER

Figure 6-19

6.15 CARGO LOADING

When seats are removed for cargo stowage, the Basic Empty Weight and corresponding C.G. must be corrected prior to determination of the loading schedule. The weights and arms for these seats are:

Item	Weight	Arm	Moment
Copilot's Seat and Headrest	23	89	2047
Middle Seat & Headrest (each)	23	126	2898
Rear Seat (Total)	27.5	157	4318



MAXIMUM CAPACITY

Area	Floor Load Lbs/Sq. Ft.	Allowable Lbs.
A	100	150
B	43	820
C	100	*150 (Including 20 lbs. on shelf)

*105 lbs. max. if oxygen is installed.

MAXIMUM TIE DOWN CAPACITY

Per Tie Down Ring	95 Lbs.
Per Track	190 Lbs.
Rear Seat Belt Fittings	85 Lbs. Per Fitting

Cargo must be loaded within the weight and balance limits of this aircraft.

CARGO LOADING
Figure 6-21

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6.17 EQUIPMENT LIST

The following is a list of equipment which may be installed in the PA-23-250 (Six Place). It consists of those items used for defining the configuration of an airplane when the basic empty weight is established at the time of licensing. Items marked with an "X" are those items which were installed on the airplane described below as licensed by the manufacturer.

PIPER AIRCRAFT CORPORATION PA-23-250 (SIX PLACE), AZTEC F

SERIAL NO. ______________ REGISTRATION NO. ________________ DATE: __________

(a) Propeller and Propeller Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
1	Two Propeller Installations: Hartzell HC-E2YR-2RBSF with F8465-7R Blades Per PAC Dwg. 31470-2	________	60.3 ea.	24.0	1447
3	Two Hydraulic Governors: Hartzell F-6-28 Per PAC Dwg. 31470-2	________	6.0 ea.	37.0	222
5	Two Propeller Spinners: Spinner Per PAC Dwg. 23818, Cap Per PAC Dwg. 23819-4 and Bulkhead Adapter	________	4.0 ea.	24.0	96

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(b) Engine and Engine Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
17	Two Engines - Lycoming IO-540-C4B5	______	405.8 ea.	50.6	20550
19	Two Fuel Pumps - Electric Auxiliary (28 V) Per PAC Dwg. 33959-2	______	3.0 ea.	90.0	270
21	Two Fuel Pumps - Engine** Driven A.C. No. 6440296	______	1.7 ea.	66.0	112
23	Two Oil Coolers - Harrison Model AP09AU06-04	______	3.0 ea.	66.0	198
	or Harrison Model AP16AN05	______	3.7 ea.	70.0	259
25	Two Vacuum Pumps - Airborne Mechanisms Model 211CC	______	1.8 ea.	66.0	119
27	Two Starters - Prestolite** Model MHB-4001 (28V)	______	18.0 ea.	40.0	720
29	One Hydraulic Pump - Eastern Industries Model 1233 HNG, Type 284	______	2.0 ea.	68.5	137
31	Two Induction Air Filters Per PAC Dwg. 32198	______	5.0 ea.	74.0	370
33	Two Oil Filters - AC Full Flow No. 5578941	______	2.5 ea.	67.0	168
35	Two Hydraulic Pumps - Eastern Industries Model 1233 HNG, Type 311*	______	2.0 ea.	68.5	137

*Serial numbers 27-7654001 thru 27-7854050 when Piper Kit No. 763 836 is installed and serial numbers 27-7854051 and up.
**Included in engine weight.

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(c) Landing Gear and Brakes

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
55	Two Main Wheel and Brake Assemblies, 6.00 - 6 Type III:				
	a. Cleveland Wheel Assembly Model 40-131, Brake Assembly Model 30-96	______	15.0 ea.	114.5	1718
	b. Two Main 8-Ply Rating Nylon Tires, 7.00 - 6, Type III with Regular Tubes	______	13.0 ea.	114.5	1489
57	One Nose Wheel:				
	a. Cleveland Nose Wheel Assembly 40-76 (B)	______	3.8	24.5	93
	b. One Nose Wheel 4-Ply Rating Tire, 6.00 - 6, Type III with Regular Tube	______	9.0	24.5	228

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(d) Electrical Equipment

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
71	Landing Light, G.E. Model 4553 (28 V)	______	2.0	-18.5	-37
73	Two 70 Amp (28 V) Alternators* Prestolite with Brackets	______	13.0 ea.	37.0	481
75	One Gill 12-GCAB-9, 17 Amp Hour (24 V) Battery	______	28.0	33.0	924
77	28 V Electrical System Instl. Per PAC Dwg. 33650-2	______	Neglect Weight Change		
79	Taxi Light Assy. Per PAC Dwg. 30503	______	2.0	25.0	50
81	Stall Warning Lift Detector, Safe Flight Model C-52207-4 (28 V)	______	Neglect Weight Change		
83	Alternator Relays and Filter Per PAC Dwgs. 33196-3, 24710-5	______	4.9	53.2	261

*Incl. in Engine Weight

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(e) Instruments

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
91	a. One Turn and Bank Per PAC Dwg. 32737-6 (Mitchell)	_____	1.5	68.3	103
	or				
	b. Per PAC Dwg. 41711 (Brittain)	_____	1.5	67.8	102
93	One Rate of Climb Per PAC Dwg. 41706 or PAC Dwg. 41706-2	_____	1.0	68.8	69
95	Altimeter Per Piper PS50008-2	_____	1.3	68.6	89
97	Airspeed Indicator Per PAC Dwg. 17419-31	_____	.6	69.6	42
99	Manifold Pressure Gauge Per PAC Dwg. 19697-3	_____	1.0	69.3	69
101	Ammeter Assy. Per PAC Dwg. 23857	_____	.2	69.8	14
103	Dual Tachometer Per PAC Dwg. 25700-3	_____	.7	68.5	48
105	One Attitude Gyro Indicator Per PAC Dwg. 99002-2, 99002-3, 99002-4, or 99002-7	_____	2.0	67.3	135
107	One Directional Gyro Indicator Per PAC Dwg. 99003-2, 99003-3, 99003-4, or 99003-6	_____	2.9	67.7	196
109	Dual Fuel Flow Gauge Per PAC Dwg. 32734	_____	2.0	80.0	160
111	Hobbs Engine Hour Meter Per PAC Dwg. 51006	_____	.4	72.0	29

(e) Instruments (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
113	Airborne *1G2-1 Suction Gauge	______	.5	69.5	35
115	One Clock Per Wakmann *W-33-7510-ET or Longines *ALL-90P-ET	______	.3	70.3	21
117	Outside Air Temp. Gauge Per PAC Dwg. 41707 or 54507-2, -3	______	.3	71.0	21

(f) Miscellaneous

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
137	D.O.A. EA-1 Approved Pilot's Operating Handbook Report: 1948	______			
139	Combustion Heater Kit Assy. Per PAC Dwg. 33639-3	______	26.0	29.0	754
141	Heated Pitot Tube Assy. Per PAC Dwg. 19024-3	______	1.0	129.0	129
143	Emergency Gear Extender* (CO_2 Bottle)	______	2.0	89.0	178
145	Ballast Weight Installed Per Piper Dwg. 32330	______	—	306.0	—

*Serial numbers 27-7654001 through 27-7954121.

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(g) Engine and Engine Accessories
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (lb-In.)
161	Lycoming Turbocharger System Per PAC Dwg. 32330-8	______	Use actual Weight and Arm		
163	Two Fuel Pumps — Engine* Driven Lear Siegler RG-17980	______	1.3 ea.	66.0	86
165	Two Oil Coolers - Harrison Model AP13AU06-03	______	3.9 ea.	70.0	273
	Two Vacuum Pumps:				
167	Two Airborne Mechanisms Model 431CC7	______	5.5 ea.	66.3	365
169	Two Airborne Mechanisms Model 441CC	______	3.0 ea.	66.3	199
171	Two Induction Air Filters Per PAC Dwg. 26874	______	1.0 ea.	66.0	66
173	Tip Tank Installation Per PAC Dwg. 33826-2 and 33826-3	______	13.7	106.7	1462
175	External Fuel Gauges Per PAC Dwg. 15769-2	______	1.0	102.0	102

*Included in Engine Wt.

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(h) Propeller and Propeller Accessories (Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
187	Two Propeller Installations: Hartzell HC-E2YR-2RBSF with F8465-7R Blades Per PAC Dwg. 32330-5	______	60.3 ea.	24.0	1447
189	Two Hydraulic Governors: One Hartzell F-8-28 and One Hartzell F-6-28	______	6.0 ea.	37.0	222
191	Propeller Synchrophaser Per PAC Dwg. 33249-2	______	7.5	61.9	464
193	Propeller Synchrophaser Instl. (Hartzell) Per PAC Dwg. 28475-2	______	8.0	61.4	491

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(i) Landing Gear and Brakes
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment Lb-In.)
201	Dual Toe Brakes Per PAC Dwg. 30940	______	8.0	49.0	392
203	One Nose Wheel:				
	a. Cleveland Nose Wheel Assembly 40-76 (B)	______	3.8	24.5	93
	b. One Nose Wheel 6-Ply Rating Tire, 6.00 - 6, Type III with Regular Tube	______	9.3	24.5	228

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(j) Electrical Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
211	One Gill PS12-24 25 Amp Hour (24 V) Battery	_____	44.0	33.0	1452
213	Whelen Red Anti-Collision (Strobe) Light Per PAC Dwg. 32940-3	_____	5.1	237.6	1212
214	Emergency Locator Transmitter Per PAC Dwg. 28481-2	_____	4.2	254.2	1068
215	Emergency Locator System (PAL) Per PAC Dwg. 33542	_____	2.0	258.0	516
216	Emergency Locator Transmitter Per PAC Dwg. 28326-2	_____	2.0	258.0	516
217	Heated Windshield Panel Per PAC Dwg. 31640-3	_____	2.5	59.0	148
219	Electric Propeller Deicing Equipment (28 V) Per PAC Dwg. 32740-2	_____	12.9	42.7	551
221	External Power Receptacle Per PAC Dwg. 28381-3	_____	7.0	11.0	77
223	Wing Inspection Light Per PAC Dwg. 15754-2 or 28543-2	_____	.3	97.8	29

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(k) Instruments
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
243	a. One Turn and Bank Per PAC Dwg. 32737-5 (Mitchell)	______	1.5	68.3	103
	or				
	b. Per PAC Dwg. 41711 (Brittain)	______	1.5	67.8	102
245	One Rate of Climb Per PAC Dwg. 41706 or 41706-2	______	1.0	68.8	69
247	Altimeter Per Piper PS50008-2	______	1.3	68.6	89
249	Airspeed Indicator Per PAC Dwg. 17419-31	______	.6	69.6	42
251	One Attitude Gyro Per PAC Dwg. 99002-2, 99002-3, 99002-4, or 99002-7	______	2.0	67.3	135
252	HSI Instl. Per PAC Dwg. 09593-3	______	Neglect Weight Change		
253	One Directional Gyro Per PAC Dwg. 99003-2, 99003-3, 99003-4, or 99003-6	______	2.9	67.7	196
255	Dual Fuel Flow Gauge Per PAC Dwg. 32858-2	______	1.5	80.0	120
257	One Exhaust Gas Temperature Gauge Per PAC Dwg. 32649 or 33596-2 or 33596-3	______	2.0	80.0	160
259	One Millibar Altimeter (Pilot) Per PAC Dwg. 25717-2	______	1.3	68.6	89
261	One Millibar Altimeter (Copilot) Per PAC Dwg. 25717-4	______	1.3	68.6	89
263	One True Airspeed Indicator (Pilot) Per PAC Dwg. 32771-4	______	.6	69.6	42
265	One True Airspeed Indicator (Copilot) Per PAC Dwg. 32771-5	______	.6	69.6	42

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(l) Autopilots
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
281	Piper AutoControl IIIB Per PAC Dwg. 15710-2	_______	9.1	82.5	751
283	Piper AltiMatic IIIC Per PAC Dwg. 15600-2	_______	22.2	110.1	2444
285	Piper AltiMatic IIIC with H.S.I. and G.S. Coupler Per PAC Dwg. 15600-3	_______	24.4	107.3	2618
287	Piper AltiMatic IIIC with H.S.I., Gyro Slaving and G.S. Coupler Per PAC Dwg. 15600-4	_______	27.2	110.9	3017
289	Piper AltiMatic V F/D-1 (28 V) Per PAC Dwg. 33100-8, 33100-11, 33100-17, 33100-19, or 33100-22	_______	42.2	84.6	3570
291	Piper AltiMatic V-1 Per PAC Dwg. 33106-3 (28 V)	_______	37.3	91.4	3409
293	Glide Slope Coupler Instl. Per PAC Dwg. 15632-2 or -3	_______	2.3	57.8	133
294	Glide Slope Coupler Instl. Per PAC Dwg. 15988-2	_______	2.3	57.8	133
295	Electric Stabilator Trim Instl. Per PAC Dwg. 32765-3	_______	3.9	165.0	644
297	FCS-810 AFCS (without F/D) (28 V) Per PAC Dwg. 33106-3 Cert. Basis - STC SA429SO	_______	42.7	84.8	3621
299	FCS-810 AFCS (with F/D) (28V) Per PAC Dwg. 28400-2, -3, -4, -5 or -6 Cert. Basis - STC SA429SO	_______	37.8	91.5	3459

(l) Autopilots
(Optional Equipment) (cont.)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
301	Piper Altimatic X (Unslaved HSI) Per PAC Dwg. 28410-2 Cert. Basis - SA-3006 SW-D	———	40.1	80.6	3232
303	Piper Altimatic X (Slaved HSI) Per PAC Dwg. 28410-3 Cert. Basis - SA-3006 SW-D	———	44.4	83.3	3699
305	Piper Altimatic X AP/FD (Single Q and Split Q Horizon) Per PAC Dwg. 28411-2 or -3 Cert. Basis - SA-3006 SW-D	———	45.4	82.9	3764
307	KFC-200 FD/AP (King) Per PAC Dwg. 28550-3 Cert. Basis - STC SA1163CE	———	33.6	91.6	3078
309	KFC-200 AP (King) Per PAC Dwg. 28550-2 Cert. Basis - STC SA1163CE	———	33.6	91.6	3078

(m) Radio Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
310	KTS-2-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 15765-2 or	______	66.9	65.6	4389
	PAC Dwg. 15906-2 or	______	67.9	65.6	4454
	PAC Dwg. 09311-2 or	______	65.2	66.2	4316
	PAC Dwg. 09871-2 or	______	57.8	68.4	3954
	PAC Dwg. 09892-2 or	______	44.3	79.0	3500
	PAC Dwgs. 09311-2 and 09278-6 (less transponder) or	______	61.5	66.4	4084
	PAC Dwgs. 09311-2 and 09278-7 (less DME) or	______	53.7	71.2	3823
	PAC Dwgs. 09311-2, 09278-6 and 09278-7 (less transponder and DME)	______	50.0	71.9	3595
311	KTS-3-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 09496-2 or	______	59.7	68.4	4083
	PAC Dwg. 09981-2 or	______	48.6	74.9	3640
	PAC Dwgs. 09496-2 and 09555-7 (less DME) or	______	53.9	70.8	3816
	PAC Dwgs. 09496-2 and 09555-6 (less transponder) or	______	55.5	69.2	3841
	PAC Dwgs. 09496-2, 09555-7 and 09555-6 (less DME and transponder)	______	49.7	71.9	3573
313	KTS-4-23 (I) Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 33940-2 or	______	101.1	70.1	7087
	PAC Dwg. 15907-2	______	102.1	70.1	7157
314	KS-1-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 33929-2 or	______	44.4	77.4	3437
	PAC Dwg. 15905-2 or	______	45.4	77.4	3514
	PAC Dwg. 09310-2	______	43.4	76.7	3328

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
315	KS-1-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per PAC Dwg. 09494-1 or	———	43.4	76.7	3328
	PAC Dwg. 09494-2 and 09584-6 (less transponder)	———	40.4	76.7	3099
316	KS-2-23 Avionics Instl. (Includes all standard group components. Does not include standard features per PAC Dwg. 09495-2 or	———	46.2	78.1	3608
	PAC Dwgs. 09495-2 and 09493-6 (less transponder)	———	42.0	80.1	3364
317	N-1-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per PAC Dwg. 33916-2	———	45.5	68.8	3130
319	N-2-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per PAC Dwg. 33890-2	———	51.7	73.2	3784
321	NT-3-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per PAC Dwg. 33890-3	———	51.7	73.2	3784
	PAC Dwg. 15903-2	———	52.7	73.2	3858
323	NT-4-23 (I) Avionics Instl. (Includes all standard group components. Does not include standard features) Per PAC Dwg. 33931-2	———	81.1	75.0	6082

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Inst.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
325	CTM-1-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 15908-2 or	______	57.5	67.6	3887
	PAC Dwg. 09312-2 or	______	46.5	73.1	3399
	PAC Dwg. 09544-2	______	46.5	73.1	3399
327	CTM-2-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 09545-2 or	______	55.2	69.0	3809
	PAC Dwg. 08026-2 or	______	55.2	69.0	3809
	PAC Dwgs. 09313-2 and 09282-6 (less DME) or	______	48.6	73.2	3558
	PAC Dwgs. 09545-2 and 09577-6 (less transponder) or	______	46.8	73.4	3435
	PAC Dwgs. 09545-2 and 09577-7 (less transponder) or	______	53.2	69.0	3671
	PAC Dwgs. 09545-2, 09577-6 and 09577-7 (less DME and transponder)	______	44.8	73.4	3288
329	NC-1-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 09314-2	______	33.7	84.9	2861
331	NC-2-23 Avionics Instl. (Includes all standard group components. Does not include standard features) Per				
	PAC Dwg. 09315-2 or	______	44.6	74.4	3318
	PAC Dwgs. 09315-2 and 09317-2 (less DME) or	______	35.5	83.1	2950
	PAC Dwgs. 09315-2 and 09317-3 (less transponder) or	______	42.1	74.9	3153
	PAC Dwgs. 09315-2, 09317-2 and 09317-3 (less transponder and DME)	______	33.0	84.4	2785

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
333	BX-1-23 Avionics Installation (Includes all standard group components. Does not include standard features) Per PAC Drawing 09647-2 or	____	59.0	63.5	3746
	PAC Dwgs. 09647-2 and 09648-6 (less DME) or	____	47.3	69.3	3278
	PAC Dwgs. 09647-2 and 09648-9 (less Transponder) or	____	54.4	64.0	3482
	PAC Dwgs. 09647-2, 09648-6 and 09648-9 (less transponder and DME)	____	42.7	70.6	3015

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
335	Nav/Comm 1 Instl. (Narco) Per PAC Dwg. 33559-3	______	11.8	52.8	623
337	Nav/Comm 1 Instl. (Narco) Per PAC Dwg. 33559-6	______	12.1	53.4	646
339	Nav/Comm 1 Instl. (Narco) Per PAC Dwg. 33582-3	______	14.3	74.4	1064
341	Nav/Comm 1 Instl. (King) Per PAC Dwg. 33398-3	______	13.6	74.5	1013
343	Nav/Comm 1 Instl. (King) Per PAC Dwg. 33878-2	______	16.6	62.3	1034
345	Nav/Comm 1 Instl. (King) Per PAC Dwg. 33878-3	______	16.6	61.5	1021
347	Nav/Programmer Installation (Bendix) Per PAC Dwg. 09648-3	______	7.6	64.4	489
349	Comm 1 Instl. (Narco) Per PAC Dwg. 33912-3 or -5	______	5.2	61.7	321
353	Nav 2 Instl. KN-53 (King) with Glide Slope Rec. per PAC Dwg. 09979-2		Neglect Weight Change		
355	Nav 1 Instl. (Narco) Per PAC Dwg. 33592-4	______	6.4	83.7	536
357	Nav 1 Instl. (Narco) Per PAC Dwg. 33593-4	______	6.4	83.7	536
363	HF Comm Instl. (ABS-130) Per PAC Dwg. 15575-2	______	25.4	81.0	2057
364	HF Comm Instl. (ABS-130) Per PAC Dwg. 09273-2	______	25.4	81.0	2057

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
371	Nav/Comm 2 Instl. (Narco) Per PAC Dwg. 33562-6 or PAC Dwg. 33581-6	______	8.5	63.2	537
373	Nav/Comm 2 Instl. (Narco) Per PAC Dwg. 33581-3	______	9.2	71.0	653
375	Nav/Comm 2 Instl. (Narco) Per PAC Dwg. 33562-3	______	8.2	62.1	509
377	Nav/Comm 2 Instl. (King) Per PAC Dwg. 33399-3	______	12.6	63.5	800
379	Nav/Comm 2 Instl. (King) Per PAC Dwg. 33401-3 or -6	______	16.8	57.7	969
383	ADF Installation (Second Bendix) Per PAC Dwg. 09648-5	______	4.4	83.1	366
385	ADF Instl. (KR-85) Per PAC Dwg. 09593-5	______	1.3	64.5	84
387	ADF Indicator Instl. (Slaved KI-225) Per PAC Dwg. 09555-3 or 09493-3 or 09879-2	______	Neglect Weight Change		
388	ADF Instl. (KR-86) Per PAC Dwg. 15580-2	______	6.4	108.6	695
389	ADF Instl. (Dual 140) Per PAC Dwg. 33909-2	______	22.7	65.1	1478
390	ADF Instl. (Dual 140) Per PAC Dwg. 33909-3	______	23.0	65.0	1495
391	ADF Instl. (Dual KR-85) Per PAC Dwg. 33526-6	______	22.9	74.6	1708
392	ADF Instl. (KR-85) Per PAC Dwg. 33268-10	______	8.3	101.5	843
393	ADF Instl. (140) Per PAC Dwg. 33883-2	______	12.0	88.6	1063

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
394	Dual ADF Instl. (KR-85) Per PAC Dwg. 09278-8	______	22.9	74.6	1708
395	Dual ADF/RMI (KR-85 and KI-226) Per PAC Dwg. 09278-11	______	26.7	67.2	1794
396	Dual ADF/RMI (KR85 and KI-226 Per PAC Dwg. 09278-12	______	26.7	67.2	1794
397	Dual ADF Instl. (RCR-650) Per PAC Dwg. 09282-7	______	12.2	76.6	935
398	Dual ADF Instl. (RCR-650 with RMI) Per PAC Dwg. 09282-8 or 09577-8	______	12.2	76.6	935
399	Transponder Instl. (KT-76) Per PAC Dwg. 33397-3 or 15975-2	______	3.7	61.5	228
401	Transponder Instl. (AT-50A) Per PAC Dwg. 33578-3	______	4.8	48.2	231
402	DME Installation (Bendix) Per PAC Dwg. 09648-10	______	Neglect Weight Change		
403	DME Instl. (IND-450) Per PAC Dwg. 09563-3	______	8.4	44.6	375
405	DME Instl. (IND-451) Per PAC Dwg. 09577-9 or 08054-2	______	Neglect Weight Change		
407	DME Instl. (King) Per PAC Dwg. 33598-3	______	10.6	42.6	452
409	DME Instl. (KN-62) Per PAC Dwg. 09593-4	______	3.3	64.4	213
411	DME Instl. (Narco) Per PAC Dwg. 33882-2	______	6.1	63.7	389
412	DME Instl. (King) Per PAC Dwg. 15755-2, -3, -4, -5 or 15973-2, -3, -4, -5	______	9.0	34.8	313

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Inst.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
413	DME Instl. (King) Per PAC Dwg. 15772-2, -3, -4, -5 or 15974-2, -3, -4, -7	———	11.0	43.4	477
414	DME Instl. (King) Per PAC Dwg. 15775-2 or -3	———	11.0	43.4	477
415	DME Instl. (King) per PAC Dwg. CA-23-1-820-2	———	11.5	43.2	497
416	DME Instl. (King KN-65A) Per PAC Dwg. 09276-4	———	11.0	43.4	477
417	DME Instl. (King KN-65A) Per PAC Dwg. 09276-7	———	11.9	42.8	509
418	DME Instl. (King KN-65A) Per PAC Dwg. 09281-3 or 09281-5	———	11.9	42.8	509
419	DME Instl. (KN-65A) Per PAC Dwg. 09278-13	———	Neglect Weight Change		
420	R-Nav Instl. (ANS-351) Per PAC Dwg. 09577-3 or 09577-4 or 08052-2 or 08052-3	———	1.7	66.1	112
421	Nav 1/R-Nav with Glide Slope Rec. Instl. KNS-81 (King) per PAC Dwg. 09987-2	———	2.5	64.9	162
422	R-Nav Instl. (KN-74) Per PAC Dwg. 15740-2 or 15976-2	———	*8.2	59.3	486
423	R-Nav Instl. (KN-74) Per PAC Dwg. 15740-3 or 15976-3	———	*5.2	57.5	299
425	R-Nav Instl. (KN-74) Per PAC Dwg. 15740-4 or 15976-4	———	*3.0	72.9	219
426	R-Nav Instl. (KN-74) Per PAC Dwg. 15740-5 or 15976-5	———	*5.2	57.5	299
427	R-Nav Instl. (KN-74) Per PAC Dwg. 15740-6 or 15976-6	———	*5.7	55.7	318

*Weight does not include weight of DME.

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Inst.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
428	R-Nav Instl. (KN-74) Per PAC Dwg. 15976-7	______	3.8	81.8	311
429	R-Nav Instl. (KN-74) Per PAC Dwg. 15976-8	______	13.6	51.0	694
430	R-Nav Instl. (KN-74) Per PAC Dwgs. 09276-6 and 09278-3	______	3.0	72.9	219
431	R-Nav Instl (KN-74) Per PAC Dwg. 09276-5	______	3.7	61.5	228
432	R-Nav Inst.. (KN-74) Per PAC Dwg. 09281-4	______	3.0	72.9	219
433	R-Nav Instl. (KN-74) Per PAC Dwg. 09282-3	______	3.0	72.9	219
434	R-Nav Instl. (CLC-60A) Per PAC Dwg. 33974-2 or -3	______	15.3	46.8	716
435	R-Nav Instl. (CLC-60) Per PAC Dwg. 33974-4	______	15.3	46.8	716
436	R-NAV Instl. (King) per PAC Dwg. CA-23-1-710	______	*5.7	55.7	318
437	Audio Panel and Marker Beacon Instl. Per PAC Dwg. 33577-3	______	3.5	37.8	132
439	Audio Panel and Marker Beacon Instl. Per PAC Dwg. 33864-3	______	5.0	41.7	209
443	Audio Amplifier and Marker Beacon Instl. Per PAC Dwg. 15770-2 or -3	______	4.2	50.5	212

*Weight does not include DME

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
447	Anti-Static Equipment Instl. Per PAC Dwg. 31628	———	2.0	171.3	343
449	Anti-Static Equipment Instl. Per PAC Dwg. 31628-2	———	2.4	171.3	411
454	Altimeter Instl. (Radar) Per PAC Dwg. 09585-3	———	6.4	189.9	1215
455	Altimeter Instl. (Radar) Per PAC Dwg. 33201-2 or -3 and PAC Dwg. 09585-2	———	7.1	192.9	1370
456	Altimeter Instl. (Encoding) Per PAC Dwg. 15570-2 or -3	———	2.1	67.0	141
457	Altimeter Instl. (Encoding) Per PAC Dwg. 09588-2	———	2.2	70.8	156
458	Altimeter Instl. (Encoding) Per PAC Dwg. 15564-2 or -3	———	3.5	67.0	234
459	Altimeter Instl. (Encoding) Per PAC Dwg. 15892-3 or -4	———	2.4	66.8	160
460	Altimeter Instl. (Encoding) Per PAC Dwg. 15892-2	———	3.4	66.6	226
461	Altimeter Instl. (Encoding) Per PAC Dwg. 15980-2	———	2.2	65.7	145
462	Altimeter Instl. (Encoding) Per PAC Dwg. 09235-2	———	2.1	67.0	141
463	Altimeter Instl. (Blind Encoding) Per PAC Dwgs. 09238-2, 09238-3 or 09893-2	———	1.6	42.5	68
464	Radar Instl. (KWX-40) Per PAC Dwg. 15470-2	———	20.9	8.7	182
465	Radar Instl. (RDR-150) Per PAC Dwg. 28297-2 or 09618-2	———	22.1	10.5	232
466	Radar Instl. (RDR-150) Per PAC Dwg. 09285-2	———	23.9	7.7	183

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Inst.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
467	Radar Instl. (RDR-150 Color) Per PAC Dwg. 09619-2 or 09619-2	______	26.3	24.8	652
468	Radar Instl. (RDR-150 Color) Per PAC Dwg. 09299-2 or 09620-2	______	27.9	16.7	466
469	Radar Instl. (RDR-160) Per PAC Dwg. 09308-2 or 09621-2	______	17.5	13.8	241
470	Radar Instl. (Primus 20B) Per PAC Dwg. 09302-2 or 09334-3	______	28.4	13.5	383
471	Radiotelephone Instl. (KT-96) Per PAC Dwg. 09334-2	______	6.2	68.4	424
472	Copilot Mike and Headset Instl. Per PAC Dwg. 33589 or PAC Dwg. 33953-2	______	1.2	72.5	87
473	Pilot Mike and Headset Instl. Per PAC Dwg. 33587 or PAC Dwg. 33911-2	______	1.2	81.3	98
475	Boom Mike Instl. Per PAC Dwg. 32946	______	1.6	81.0	130
476	RMI Instl. (KI-229) Per PAC Dwg. 09881-2	______	8.1	43.7	354
477	RMI Installation (KI-226) Per PAC Dwg. 09648-4 or 09648-7	______	7.3	46.1	337
478	VOR/LOC Antenna Instl. Per PAC Dwg. 33902-2	______	1.6	296.8	475
479	RMI Instl. (KI-226) Per PAC Dwg. 28292-2	______	6.8	42.4	288
480	RMI Instl. (KI-226) Per PAC Dwg. 33620-5 or 15977-3	______	7.3	41.0	299
481	RMI Instl. (KI-226) Per PAC Dwg. 33620-3 or 15977-2	______	13.2	60.9	804

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Inst.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
482	RMI Instl. (KI-226) Per PAC Dwg. 09278-4, 09555-4 or 09493-4	______	7.3	41.0	299
483	RMI Instl. (KI-226) Per PAC Dwg. 09278-5, 09493-7 or 09555-5	______	7.3	41.0	299
484	RMI Instl. (KI-226) Per PAC Dwg. 09282-4 or 09577-5	______	7.3	43.3	316
485	Dual ADF RMI Instl.				
	a. With Unslaved HSI Per PAC Dwg. 15833-2	______	30.8	67.2	2070
	b. With Slaved HSI Per PAC Dwg. 15833-3	______	26.7	67.2	1794
486	Dual ADF RMI Instl. Per PAC Dwg. 15930-2	______	Neglect Weight Change		
487	King KX-175BE Transceiver in lieu of King KX-170B Transceiver Per PAC Dwg. 09493-8	______	Neglect Weight Change		
488	King KX-175BE Transceiver in lieu of King KX-175B Transceiver Per PAC Dwgs. 09278-9, 09278-10, 09555-8 and 09555-9	______	Neglect Weight Change		
489	King KX-175B Transceiver in lieu of King KX-170B Transceiver Per PAC Dwg. 09493-6	______	Neglect Weight Change		
490	Circuit Protector Instl. Per PAC Dwg. 33924-2	______	1.2	70.3	84
491	Circuit Protector Instl.				
	a. Per PAC Dwg. 15481-2	______	1.3	69.6	91
	b. Per PAC Dwg. 15481-4	______	1.4	69.6	97

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
493	Circuit Protector Instl. Per PAC Dwg. 33967-2, -3 or -4	______	.3	70.3	21
495	Circuit Protector Instl. Per PAC Dwg. 33937-2 or PAC Dwg. 33936-2	______	1.0	70.3	70
497	Power Inverter Installation (P-20) Per PAC Dwg. 09648-8	______	4.3	34.7	149.2
501	Center Instrument Panel Cover Instl. Per PAC Dwg. 33881-2 or 15802-2 or 33934-2 or 15766-2 or 33955-2 or 15776-2	______	Neglect Weight Change		
503	Custom Instrument Panel (Left) Per PAC Dwg. 33915-2	______	Neglect Weight Change		
509	Trim Cover Per PAC Dwg. 80417-5	______	.2	70.8	14
511	Interface Unit Installation Per PAC Dwg. 09648-11	______	Neglect Weight Change		
513	HF Support Cover Per PAC Dwg. 33939-2	______	Neglect	70.8	
519	Radio Support Brackets Instl. Per PAC Dwg. 33891-2	______	1.0	61.3	61
521	Radio Support Brackets Instl. Per PAC Dwg. 15760-2	______	.7	66.3	46
523	Radio Support Brackets Instl. Per PAC Dwg. 33933-2	______	.7	64.8	45
525	Radio Support Brackets Instl. Per PAC Dwg. 15757-2	______	.7	68.5	48

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
527	Radio Support Brackets Instl. Per PAC Dwg. 15764-2	______	.6	69.7	42
535	Radio Mounting Shelf Instl. Per PAC Dwg. 33919-2	______	1.0	61.3	61
537	Bracket Assy. Per PAC Dwg. 33938-2	______	.1	70.8	7
541	Radio Cooling Tube Instl. Per PAC Dwg. 31137	______	.8	58.5	47
543	Radio Cooling Tube Instl. Per PAC Dwg. 32177	______	.4	55.4	22
549	Shim Per PAC Dwg. 33925-3	______	Neglect Weight Change		
551	Clip Per PAC Dwg. 22344 or -3	______	Neglect	70.7	
557	Placard Per PAC Dwg. 80287-2 or -3, or 80407-2	______	Neglect Weight Change		
559	Flight Clearance Switch Instl. Per PAC Dwg. 28525-2	______	.3	62.3	19
561	Converter Instl. (KN-72) Per PAC Dwg. 09276-3	______	1.3	36.0	47

(n) Miscellaneous
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
601	Curtain Instl. Per PAC Dwg. 33831-2	______	3.0	120.0	360
603	Pneumatic Deicing Equipment Per PAC Dwg. 15585-3	______	*24.2	136.4	3303
605	Propeller Ice Shield Per PAC Dwg. 33498	______	2.8	24.4	68
607	Heated Pitot Tube Assy. Per PAC Dwg. 19024-3	______	1.0	129.0	129
609	Fire Extinguisher Per PAC Dwg. 34985	______	5.0	101.0	505
611	Oxygen System Per PAC Dwg. 33835-2	______	48.0	161.0	7728
613	Alternate Static Source Per PAC Dwg. 32655-3	______	Neglect Weight Change		
615	Radome Installation Per PAC Dwg. 33321, 33350 or 33350-2	______	.5	-13.8	-7
617	Shoulder Harness Instl. (Center Seats with Inertia Reels) Per PAC Dwg. 32896-5	______	2.4	136.0	326
619	Shoulder Harness Instl. (Rear Seats with Inertia Reels) Per PAC Dwg. 33681-2	______	4.0	158.0	632

*Weight does not include weight of pumps.

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DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION

OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Aztec F is a twin-engine, retractable landing gear, all metal airplane which is designed to combine multi-engine power, performance, and safety with smooth, easy handling characteristics and operational adaptability.

The Aztec F has comfortable six-place seating and two separate one hundred fifty pound luggage compartments. All seats are removable to accommodate a variety of passenger and cargo combinations, and a wide range of options permits the airplane to be custom suited to individual navigation and transportation needs. As with any aircraft, the Aztec F requires proper loading; however, the weight and balance calculator provided with the airplane makes the determination of acceptable fuel and payload combinations easy and uncomplicated.

7.3 AIRFRAME

The fuselage of the Aztec F is composed of four basic units: the nose section, which is made of sheet metal and fiberglass, the cabin section and the tail cone, which are made of sheet metal, and the tubular steel structure which extends from the nose wheel to the tail cone. The tubular steel unit strengthens the center section of the airplane, where heavier loads are imposed. The extremeties (nose cone, engine cowling nose bowls, wing tips) are constructed of dent resistant reinforced fiberglass. The Aztec F is not designed for aerobatic flying; therefore, aerobatics in this airplane are prohibited.

Access to the cabin is through the cockpit door on the right side of the fuselage. The forward baggage compartment door is located on the right side of the nose section, and the aft baggage compartment door is on the right side of the fuselage, aft of the rear window.

Except for the second window on the left side, which is the emergency exit window, all windows are double pane. A storm window located in the forward lower section of the pilot's side window opens downward and in when unlatched.

The wing is of a conventional design and employs a USA 35B modified airfoil section. The wing spar ends are bolted together, providing, in effect, a continuous main spar. The wings are also attached to the tubular steel structural unit by auxiliary front and rear spars fore and aft of the main spar. The dent resistant fiberglass wing tips are detachable for service.

Four thirty-six gallon fuel tanks are mounted in the wings; two tanks are located outboard of each engine nacelle. Each wing also incorporates provisions for the addition of an optional twenty gallon wing tip fuel tank. These tanks are flexible, bladder type fuel cells.

The empennage is made up of a vertical stabilizer and rudder and an all-movable horizontal stabilator. All surfaces of the empennage are sheet metal with the exception of the durable thermoplastic tip of the rudder and the tips of the stabilator.

All six seats in the Aztec F are removable. The crew seats and center seats are individual bucket seats, and the rear seat is a couch type which will accommodate two people.

7.5 ENGINES (NORMALLY ASPIRATED)

The Lycoming IO-540-C4B5 six cylinder engines on the Aztec F are rated at 250 horsepower at 2575 RPM. These engines have a compression ratio of 8.5:1 and require 91/96 minimum octane aviation fuel.

Each air cooled engine is equipped with a geared starter, an alternator, a vacuum pump, a fuel injector, two magnetos, a shielded ignition system, a diaphragm fuel pump, a propeller governor and an oil thermostat. A hydraulic pump is mounted on the left engine.

The exhaust system is a crossover type with exhaust gases directed overboard at the bottom of the nacelles in the area of the outboard cowl flap.

For detailed information and instruction on the engines, refer to the Lycoming Operator's Manual supplied with the airplane.

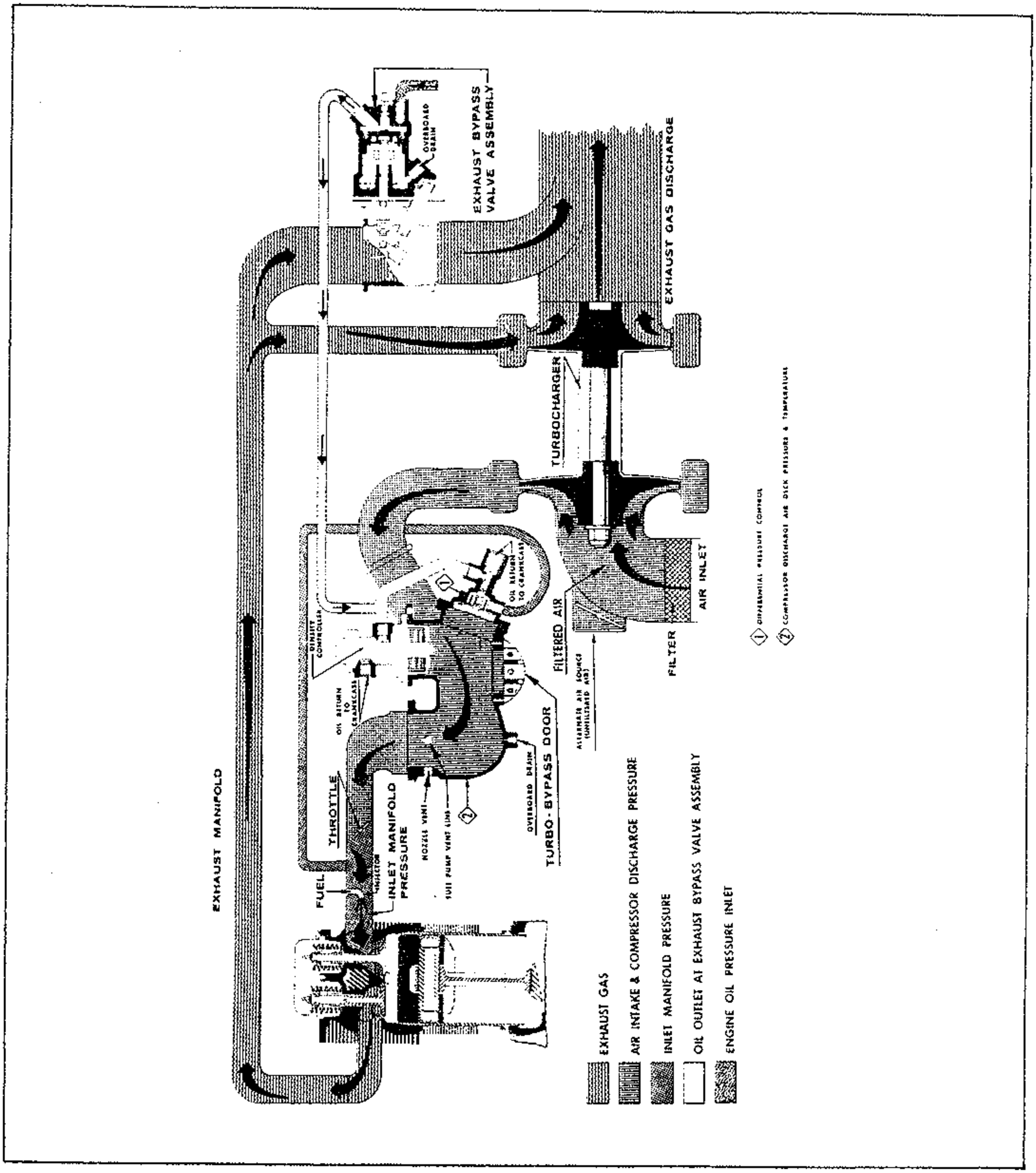
7.7 ENGINES (TURBOCHARGED)

The Aztec F can be equipped with Lycoming TIO-540-C1A turbocharged engines which are rated at 250 horsepower at 2575 RPM. Their compression ratio is 7.2:1 and they require 100/130 minimum octane aviation fuel.

The main difference between these engines and the normally aspirated engines is the Lycoming TEO659 turbochargers mounted as integral parts of each engine. The turbocharger increases power output and efficiency by supplying compressed air to the engine intake manifold. This allows operation at peak power at much higher altitudes than with normally aspirated engines. Exhaust gases supply the power to drive the turbochargers. The exhaust gases are ducted through a turbine wheel, which drives the compressor, supplying compressed air to the engine. Exhaust gas is then directed overboard at the bottom of the nacelles in the area of the outboard cowl flap.

The engines are equipped with bypass doors on the induction housings, and in the event of a turbocharger compressor failure the engine will automatically revert to normally aspirated air. Under these conditions approximately 85% of normal rated power or 212 HP will be available at sea level.

For detailed information and instruction on the engines, refer to the Lycoming Operator's Manual supplied with the airplane.



TURBOCHARGER SYSTEM SCHEMATIC

Figure 7-1

7.9 ENGINE ACCESSORIES

Engine mounts are constructed of steel tubing and incorporate vibration reducing Lord mounts. Engine cowls are cantilever structures, attached at the fire wall. The engines are easily accessible through side panels which are removable by unlatching the screw-type quick release fasteners located around the edges of the panels. The cowling nose bowl is split to allow its easy removal with the propeller intact.

An efficient aluminum oil cooler is mounted on a rear baffle of each engine. Engine oil may be drained through the quick oil drain valves located on the rear inboard corner of each engine crankcase. Access doors for the oil drains are on the inboard bottoms of the nacelles, forward of the leading edges of the wings. The combination oil filler and dipstick is accessible through a hinged door on the top of the engine nacelle. Both access doors are secured by single quarter-turn fasteners.

The engine air induction system consists of a dry type air filter and an alternate air door. During normal operation, air is inducted through the air filters. Should ice or other obstructions block an air filter, the alternate air door will open automatically to ensure airflow to the engine. Manual alternate air controls are located on the control pedestal. These controls allow the pilot to select alternate air should the automatic feature fail or should the airplane be entering known or expected icing conditions. Since alternate air is unfiltered, it should not be used during ground operations when dust or other contaminants might enter the system.

The fuel injection system reduces the possibility of icing and provides equal fuel distribution to all cylinders. A metering system measures the rate of engine air consumption and dispenses fuel to the cylinders proportionally.

The two cowl flaps for each engine are located on the underside of the nacelle, one inboard and one outboard. Their function is to provide additional cooling during ground operations, in high temperature conditions, during climbs, in situations when cylinder head temperature or oil temperature become excessive, or when an alternator is heavily loaded. Cowl flaps are manually operated by push-pull controls mounted in the cockpit on the fuel control panel between the crew seats.

The magneto switches and the starter are located on the left side panel. There are two magneto switches for each engine. The single starter switch is a rocker type. Depressing the forward side of the switch operates the right engine starter; depressing the aft side operates the left.

7.11 PROPELLERS

Propellers on the Aztec F are Hartzell HC-E2YR-2 series controllable pitch, constant speed and full feathering units. Governors, one on each engine, control the pitch of the blades by supplying engine oil at varying pressures through the propeller shaft. Increased oil pressure and back-up springs decrease the pitch of the blades. Decreased oil pressure allows compressed air in the cylinder dome to increase the pitch of the blades; and an absence of oil pressure allows the compressed air to feather a propeller. The automatic variations in pitch allow load torque to be matched to engine torque in response to changing flight conditions. A loss of engine oil pressure will cause a propeller to feather.

Propeller speed is controlled by the levers in the center of the control pedestal. Feathering is accomplished by moving the propeller control levers fully aft through the low RPM detent and into the feathering position. Feathering takes approximately three to ten seconds. Moving the propeller control forward and engaging the starter will unfeather a propeller.

A propeller synchrophaser installation is available as optional equipment. Its function is to maintain both propellers at the same RPM and at a preselected phase angle. This eliminates the propeller "beat" effect and minimizes vibration. When the synchrophaser is installed, the left engine is established as the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM. When the propeller synchrophaser is installed, a two-position switch is located on the lower left side of the instrument panel. It is labeled "MAN." for manual or standby and "Prop. Sync." for propeller synchrophaser.

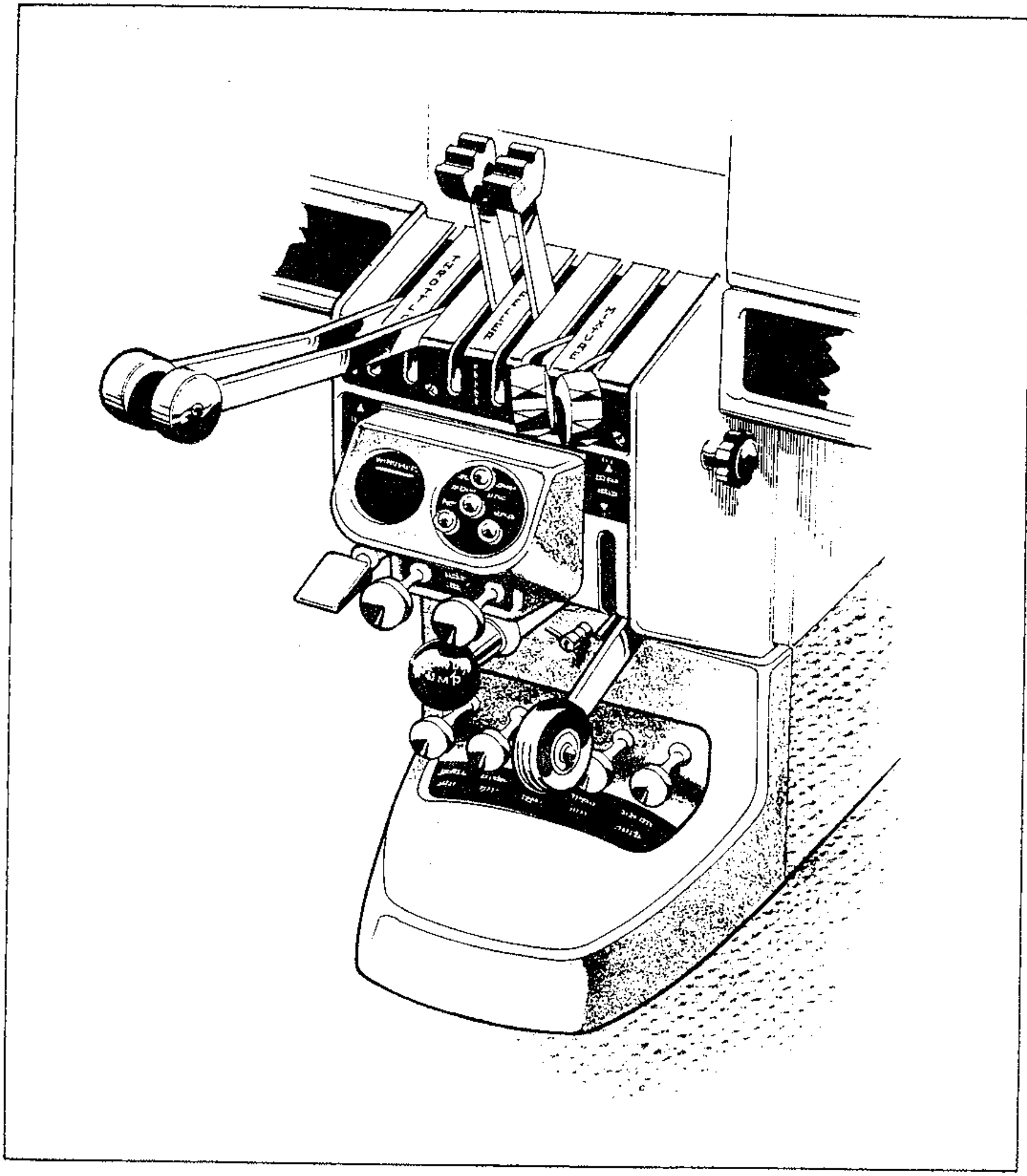
During taxiing, takeoff and landing, the propeller synchrophaser switch should be in the "MAN." position. During cruise, propellers should be synchronized manually to within approximately 10 RPM and the switch placed in the "Prop. Sync." position. Normally, propeller synchrophasing will take place within a few seconds, but occasionally it may take up to a full minute. When the power setting is to be changed, the synchrophaser switch should be set to "MAN." for 30 seconds before the power setting is adjusted; then the synchrophaser switch may be returned to the "Prop. Sync." position. If the propeller RPM differential exceeds 50 RPM, the switch should be placed on "MAN." for 30 to 40 seconds; then the propellers can be re-synchronized and the switch returned to "Prop. Sync." Pulling the circuit breaker completely deactivates the propeller synchrophaser system. If the master switch is turned "OFF" or if there is an electrical system failure, the slave engine will return to the controlled selected RPM plus approximately 25 RPM (out of synchronization) regardless of the position of the synchrophaser switch.

7.13 FUEL INJECTION

The Bendix RSA-5 fuel injection system measures the rate at which air is consumed by the engine and regulates fuel flow proportionally. Fuel pressure regulation by means of a servo valve causes a minimal drop in fuel pressure throughout the system. The servo regulator includes the airflow sensing system, which contains a throttle valve and venturi. The differential pressure between the entrance and the throat of the venturi is the measurement of air entering the engine. These pressures are applied across an air diaphragm in the regulator. Changes in power change the airflow to the engine, thus, by metering airflow, the fuel injection system can regulate fuel flow.

Metering pressure is maintained above vapor forming conditions, while fuel inlet pressure is low enough to allow the use of a diaphragm pump. Vapor lock and associated problems of starting are thus eliminated.

Fuel is distributed to the cylinders by a ported fuel flow divider mounted on top of the engine. The divider contains a spring-loaded positive shut off valve. At each cylinder is a continuous flow air bleed nozzle with provisions to eliminate the adverse effects of low manifold pressure while idling. Since fuel metering occurs at the regulating unit rather than at the nozzles, more uniform cylinder head temperatures result, and a longer engine life is possible.



CONTROL PEDESTAL

Figure 7-3

7.15 ENGINE CONTROLS

Engine controls include a throttle, a propeller control, and a mixture control for each engine. These controls are located on a control pedestal in the center of the cockpit below the instrument panel, where they are accessible to both pilot and copilot.

The throttle levers, on the far left of the control pedestal, are used to adjust manifold pressure. The throttle levers adjust from fully open in the top position, through the idle position, to fully closed at the bottom of their travel. The throttle controls incorporate switches which activate a gear up warning horn and light if the gear is up during the last portion of travel of either of the throttle controls to the low power position. If the gear is not locked down, the warning light will illuminate and the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to prevent an inadvertent gear up landing.

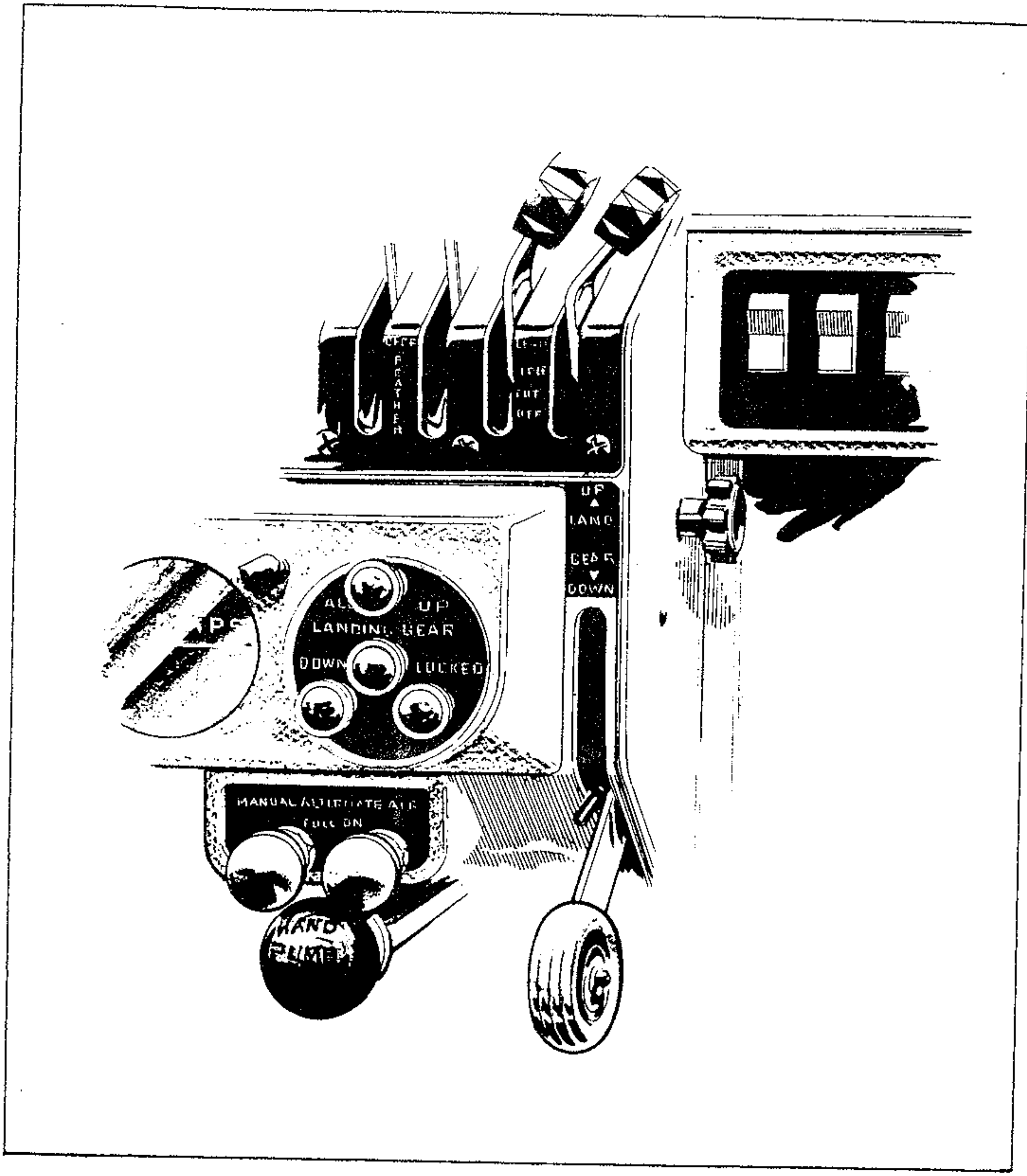
The propeller controls are located in the center of the control pedestal. They are used to adjust the propeller speed from increase RPM at the top of their travel, through decrease RPM, to the feathered position at the bottom of their travel. A governor maintains a constant propeller speed once the propeller control is set.

The mixture controls at the far right of the control pedestal adjust the air to fuel ratio. The full rich position is at the top position and the full lean position is toward the bottom. The mixture controls are used to shut down the engines in the full bottom or idle-cut-off position.

A friction adjustment knob on the right side of the control pedestal may be adjusted to increase or decrease the effort needed to move the control levers or to hold the controls in a selected position.

The manual alternate air controls are located on the control pedestal beneath the control lever quadrant. These controls serve as a back-up for the automatic system and also allow the pilot to manually select alternate engine induction air prior to entering icing conditions which may block the primary induction air source.

Cowl flap controls are located on the fuel control panel between the crew seats. Depending on the additonal engine cooling required, the cowl flap control levers can be locked in various intermediate settings between the fully open and fully closed positions.



LANDING GEAR SELECTOR

Figure 7-5

7.17 LANDING GEAR

To increase cruise speed, climb and other performance, the Aztec F is equipped with hydraulically operated, fully retractable, tricycle landing gear. All three landing gear units on the Aztec F incorporate the same type air-oil strut, and many parts are directly interchangeable.

Main wheels are Cleveland Aircraft Products 6.00 x 6 units with disc type brakes with metallic lining. Main-wheel tires are eight ply rated 7.00 x 6 tube type tires. The nose wheel is a 6.00 x 6 Cleveland unit fitted with a 6.00 x 6 tube type tire.

Through use of the rudder pedals, the nose gear is steerable through a 30 degree arc. As the nose gear retracts, the steering linkage becomes disconnected from the gear so that rudder pedal action with the gear retracted is not impeded by nose gear operation. When the airplane is being towed with power equipment, the nose gear should not be turned beyond its 30 degree arc, as damage to the nose gear and steering mechanism will result.

When the landing gear is retracted, the nose gear retracts aft into the nose section, and the main gear retract forward into the engine nacelles. Gear doors completely cover the gear when it is retracted.

The landing gear control knob is located on the control pedestal. The landing gear control knob is in the shape of a wheel to differentiate it from the flap control knob, which has an airfoil shape. To guard against inadvertent gear retraction while the airplane is on the ground, a mechanical latch, located just above the gear control lever, must be operated before the landing gear control lever can be moved upward. There is also an anti-retraction valve, located on the left main gear, which prevents the build-up of hydraulic pressure in the retraction system while the weight of the airplane is resting on its wheels. When the landing gear strut is extended, as in flight or when the airplane is raised on jacks, the anti-retraction valve closes, permitting normal operation.

The position of the landing gear is indicated by four lights located on the control pedestal. When the three green lights are on, all three legs of the gear are down and locked; when the amber light is on, the gear is fully retracted. When no light is on, the gear is in transit. Each gear indication light incorporates a press-to-test feature, and each may be dimmed or brightened individually by turning the light clockwise or counterclockwise.

A red light in the landing gear control knob flashes when the gear is up and either one of the throttle levers is pulled back. A gear warning horn will also sound when either throttle is pulled back beyond approximately twelve inches of manifold pressure. As a further indication of the position of the gear, visual confirmation can be made from the cockpit. The nose gear can be observed through a mirror on the inboard side of the left nacelle.

7.19 BRAKE SYSTEM

Main gear brakes are actuated by toe brake pedals on the left set of rudder pedals. Toe brakes for the right side are available as optional equipment. The brakes are hydraulically actuated by individual master cylinders mounted on the rudder pedals. The brakes hydraulic system is completely independent of the hydraulic system for the landing gear and flaps. The master cylinders are accessible through the cockpit for servicing. Fluid for the master cylinders is supplied through flexible lines from a brake fluid reservoir which is mounted inside the left nose access panel. The brakes are self-adjusting, single-disc, double housing and double piston assemblies. Toe pressure against the upper part of the rudder pedals operates the brakes.

To set the parking brake, first depress and hold the toe brake pedals and then pull out the parking brake handle. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake handle.

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

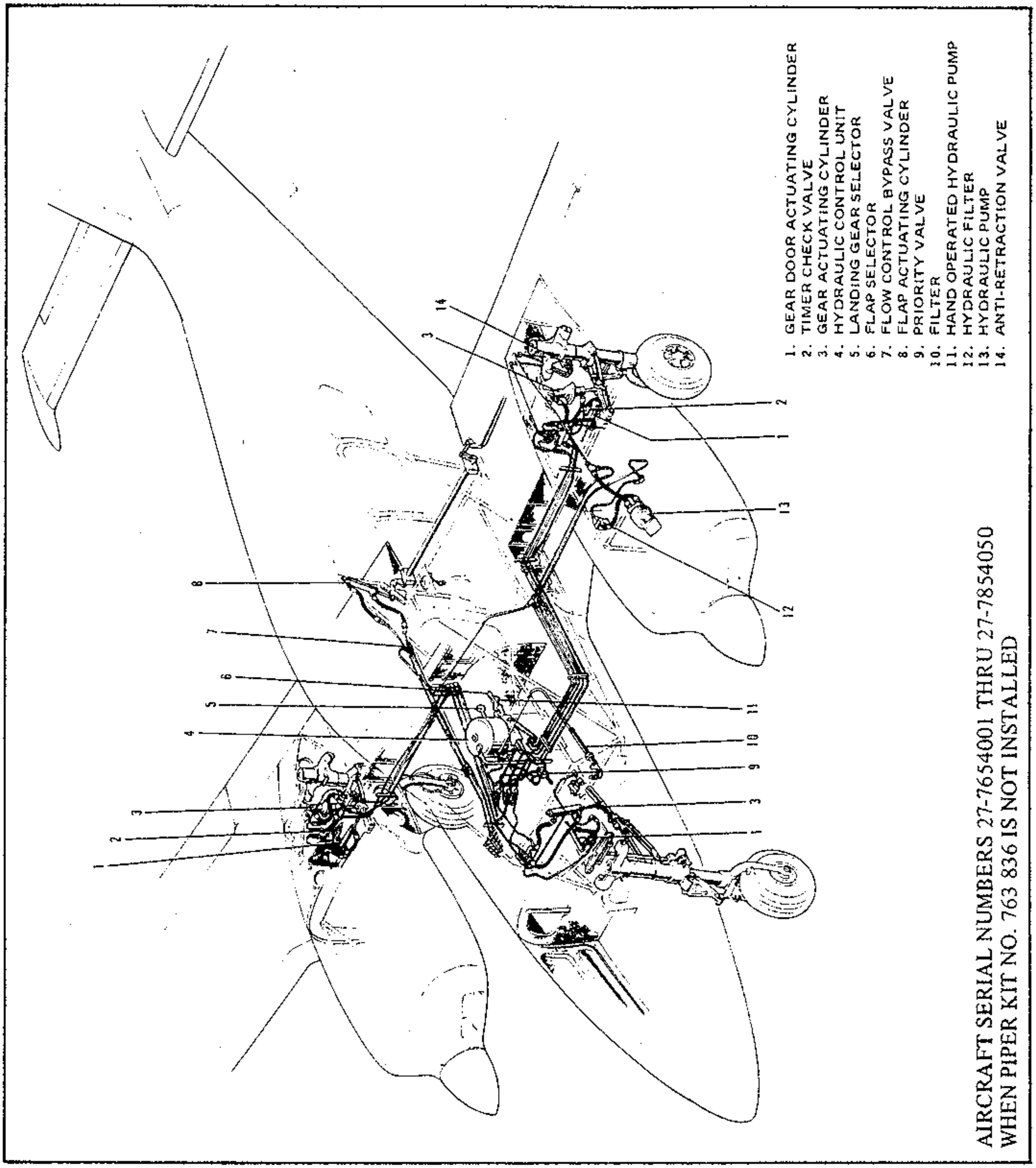
7.21 HYDRAULIC SYSTEM

The hydraulic system is used for the extension of both the landing gear and the flaps. The position of the flaps or the landing gear is controlled by the levers protruding through the face of the control pedestal. The hydraulic control unit which is also a hydraulic fluid reservoir is housed within the control pedestal. On aircraft with serial numbers 27-7654001 through 27-7854050 with Piper Kit No. 763 836 installed and serial numbers 27-7854051 and up, pressure for the hydraulic system is supplied to the control unit from two engine-driven pumps one mounted on each engine. Pressure for the system is supplied by one engine-driven hydrualic pump mounted on the left engine on aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed. Movement of the gear or flaps occur when hydraulic pressure is routed into actuating cylinders directly connected to the gear or flaps. Landing gear doors are also operated by the hydraulic system.

The gear control knob is wheel-shaped, and the flap control knob is airfoil-shaped. When a selector lever is in the off or neutral position, hydraulic fluid flows through selector ports and circulates freely between the engine-driven pump(s) and the control unit. For extension or retraction of gear or flaps, the respective control lever is moved from the center position into the desired direction. When a control lever is placed in an up or down position, the selector ports hydraulic fluid into the proper actuating cylinder. Once a selected component reaches full extension or retraction, hydraulic pressure within the control unit forces the control lever back into a neutral or off position, allowing hydraulic fluid to resume free circulation between the pump(s) and the control unit. Flap travel can be stopped at any intermediate position if the control knob is manually returned to the neutral position. Although both gear and flap levers may be moved at the same time, the flaps will not extend until the gear system completes its operation; however, the flaps will "blow" up during the retraction cycle with the priority valve supplying the gear system.

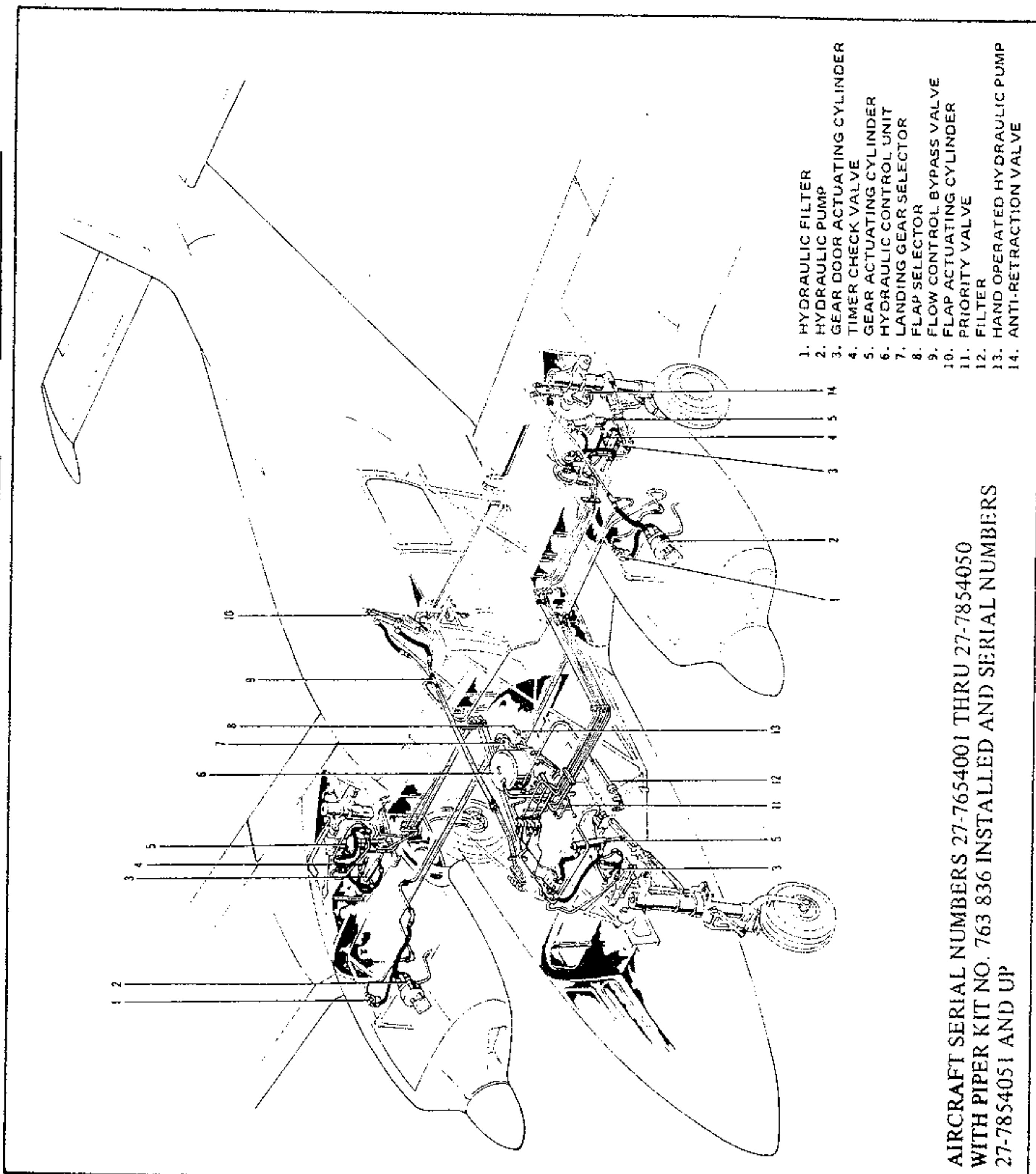
When the gear or flaps have reached their selected position, the actuating cylinders and their associated lines are isolated from the hydraulic fluid supply. This feature, along with a system of check valves, ensures the retention of sufficient fluid under pressure in the actuating cylinder to operate the landing gear in the event of a leak in the hydraulic system.

The emergency hydraulic hand pump, which is an integral part of the control unit, is used to obtain hydraulic pressure should the engine-driven pump(s) malfunction. Aircraft with serial numbers 27-7654001 through 27-7854050 when Piper Kit No. 763 836 is not installed must also use the hand pump to provide hydraulic pressure when the left engine is inoperative. To operate the hand pump, the handle should be pulled aft to its full extension and the gear or flap selector positioned as desired. Approximately fifty strokes are required to raise or lower the landing gear. At altitudes above 10,000 feet, the hand pump becomes increasingly inefficient.



HYDRAULIC SYSTEM (SINGLE HYDRAULIC PUMP)

Figure 7-7



HYDRAULIC SYSTEM (DUAL HYDRAULIC PUMP)

Figure 7-8

An additional back-up system * exists independent of the need for hydraulic fluid. The system is powered by a CO_2 cylinder, and emergency extension of the landing gear may be accomplished by this CO_2 system. The control for the CO_2 system is located beneath a small cover plate under the pilot's seat. When the control is pulled, the gear selector must be in the down position. Pulling the emergency gear extender ring releases CO_2 from a cylinder under the floor panel. The gas flows into the gear actuating cylinders, extending the landing gear. Note that this system may be used for gear extension only; it must never be used for gear retraction or operation of the flaps.

The landing gear position lights and the flap indicator, along with visual observation, should be used as primary indications of the positions of gear and flaps. Secondary indication that gear and flaps have reached their selected position is the return of the control lever to the off or neutral position.

The left main gear includes a by-pass valve which prevents the retraction of the landing gear while the airplane is on the ground. The weight of the airplane causes the valve to remain open while the strut is compressed, and all fluid by-passes directly from the pressure side of the system to the return side, preventing any build-up of hydraulic pressure in the retraction system. Note that this system is designed to prevent inadvertent retraction during aircraft start-up. The by-pass valve cannot be relied upon as the sole means of preventing retraction during high engine power on the ground or during taxi and takeoff operations. Be sure the gear handle is down before moving the aircraft.

7.23 FLIGHT CONTROL SYSTEM

Dual flight controls are installed in the Aztec F as standard equipment. The control wheels operate the ailerons and the stabilator. The rudder pedals control the rudder movement, and during ground operations also steer the nose wheel. The wheel brakes are applied by toe pressure on the top portion of the rudder pedals. These toe brakes are standard on the pilot's side. Ailerons, stabilator and rudder are cable controlled; wing flaps are hydraulically controlled. Stabilator and rudder trim are set with the control knobs located overhead.

The horizontal tail is an all-movable, slab type stabilator which incorporates an anti-servo tab along the trailing edge. The anti-servo tab, which moves in the same direction as the stabilator, but with increased travel, provides a more efficient control surface. The anti-servo tab also functions as a longitudinal trim tab for nose up or nose down correction.

The vertical tail is fitted with a rudder which incorporates a servo tab. The servo tab, which moves in a direction opposite to the travel of the rudder, lessons pedal forces necessary to move the rudder. The servo tab also functions as a rudder trim tab for nose right or nose left correction.

The knob portion of the trim control moves the rudder tab, and the crank portion moves the stabilator tab. Trim position is shown on the indicators in the overhead panel.

Wing flaps are adjustable from no flaps to 50 degrees of flap. Flap position is shown on the indicator located to the right of the flap control lever. Flaps may be set at any position between full extension and full retraction by manually returning the flap control to the neutral position when the flaps have reached the desired degree of travel. If the flap control is left in the up or the down position, the flaps will automatically extend or retract to their full travel and the lever will automatically return to the neutral position. For ease of entry or exit, the right flap may be used as a step, but only when it is fully retracted.

*Airplanes serial numbers 27-7654001 through 27-7954121 only.

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7.25 FUEL SYSTEM

Fuel for the Aztec F is stored in four wing-mounted fuel tanks. Each of these tanks, which are flexible, bladder type fuel cells, holds thirty-six U.S. gallons of fuel. Two tanks are installed in each wing outboard of the engine nacelles. Fuel capacity can be increased by the addition of two optional twenty gallon bladder type fuel cells in the wing tips. A transfer tube connecting the optional tip tank and the outboard tank allows both tanks to function as one. Two fuel fillers are located on the top of each wing; the inboard filler is for the inboard tank, and the outboard filler is for the outboard tank and the optional tip tank when it is installed. Usable fuel is 34.3 U.S. gallons per tank. All twenty gallons of fuel in each optional wing tip tank is usable; thus, when this option is installed, each outboard tank can carry in effect 54.3 gallons of usable fuel. Fuel tank vents have flame suppressing and anti-icing provisions.

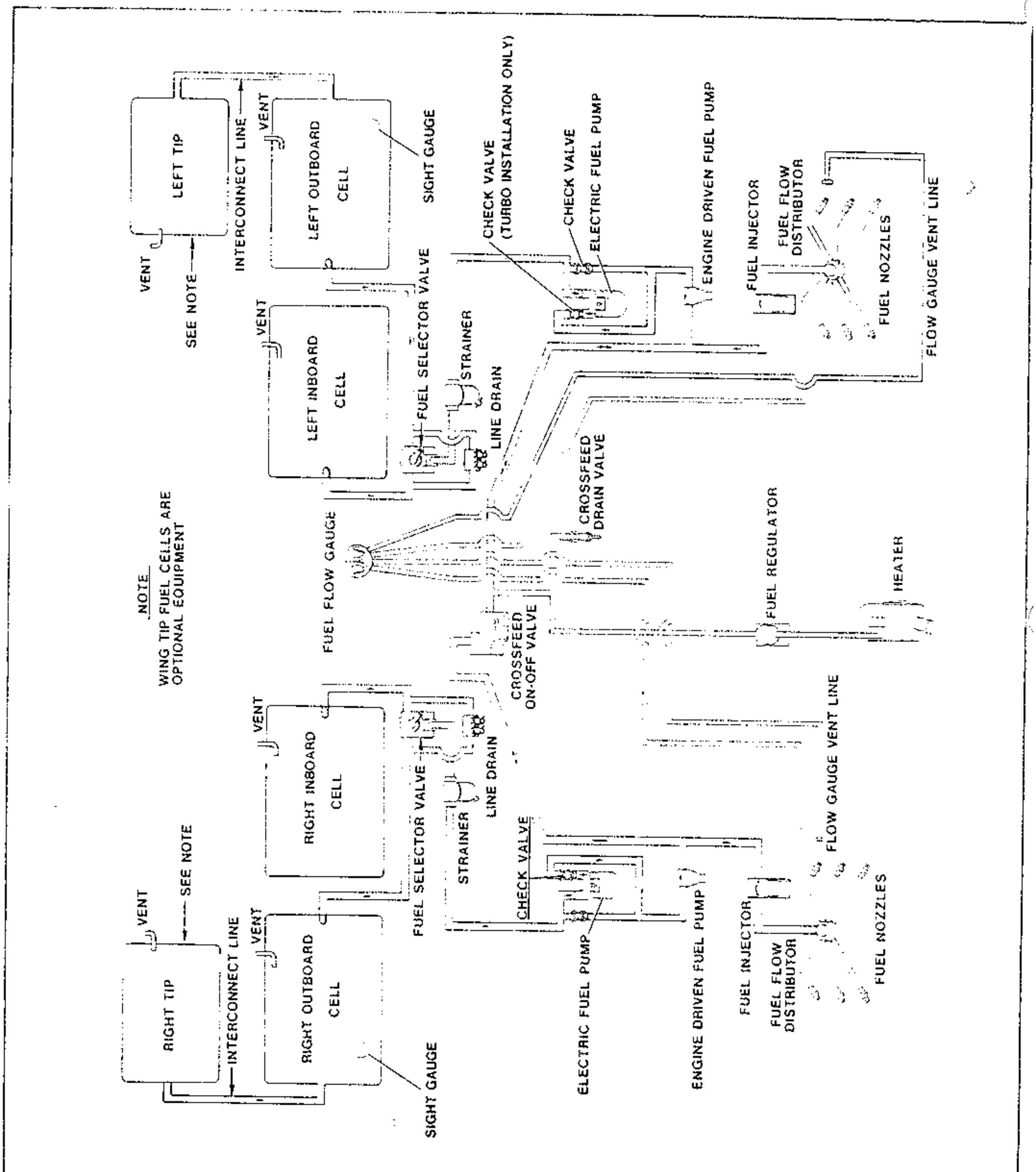
Fuel management controls are located on the control console between the crew seats. The two fuel selector and shutoff controls are used to select either the inboard or the outboard fuel tank on each side or to shut off the fuel flow on a side. Between the fuel selector controls is a crossfeed lever.

Electric fuel pump switches are located on the switch panel on the lower left instrument panel. The fuel quantity gauges are located furthest inboard on the engine gauge cluster at the top of the right instrument panel. Each fuel quantity gauge indicates the level of fuel in the tank selected on its respective side. A dual fuel flow gauge displays in gallons per hour the rate at which fuel is being supplied to each engine.

Each engine has an engine-driven fuel pump as a primary means of receiving fuel. During normal operation, both fuel selector valves are open and the crossfeed is off, and the engine-driven fuel pump on each engine is supplying fuel from a selected tank to the fuel injector on the same side. Each side of the system also has an auxiliary electric fuel pump which is used in the event of an engine-driven fuel pump failure and during takeoffs and landings to insure fuel flow during these critical times.

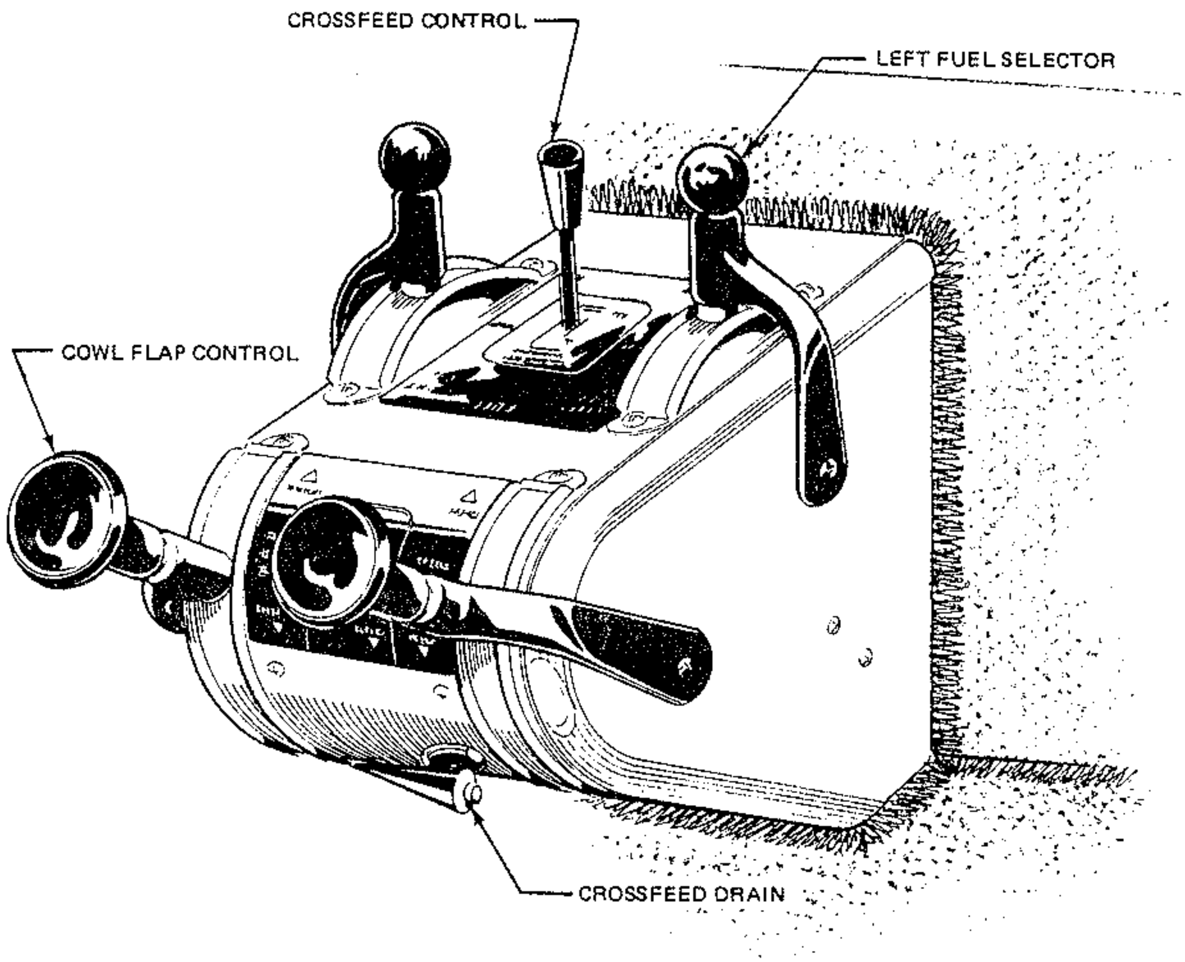
The two sides of the fuel system are connected by a crossfeed which allows fuel to be drawn from one side and sent to the engine on the other side to extend single-engine cruise range. Fuel can be supplied from any tank to either engine. The crossfeed is to be used only in emergency situations during single-engine operation. Crossfeed should not be used for takeoffs. If crossfeed is required, the fuel selector valve of the inoperative engine should be in either the inboard or the outboard position, and the electric fuel pump of the inoperative engine should be turned on; on the operative engine, the fuel selector should be in the shutoff position and the electric fuel pump should be turned off.

Before each flight, any possible accumulation of moisture or sediment in the fuel system should be drained from the low points in the system. Fuel drains are provided for each fuel tank, for each fuel strainer, and for the fuel crossfeed system. The fuel strainer drains and the fuel tank drains are located inside access doors on the underside of each nacelle, inboard of each main wheel well. The access doors are secured with quarter turn fasteners. During the preflight check, each fuel tank drain and each fuel strainer drain should be held open until any possible contaminants are removed. A fuel crossfeed drain valve control is mounted on the forward face of the fuel management control console. During preflight, this drain should be opened with the crossfeed control open and the left electric fuel pump on and off then the right electric fuel pump on and off. Close the crossfeed control. A check should then be made to insure that all drains are completely closed and that the access doors are secured. Since the fuel and vapors are extremely flammable, precautions should be taken to avoid fire hazards.



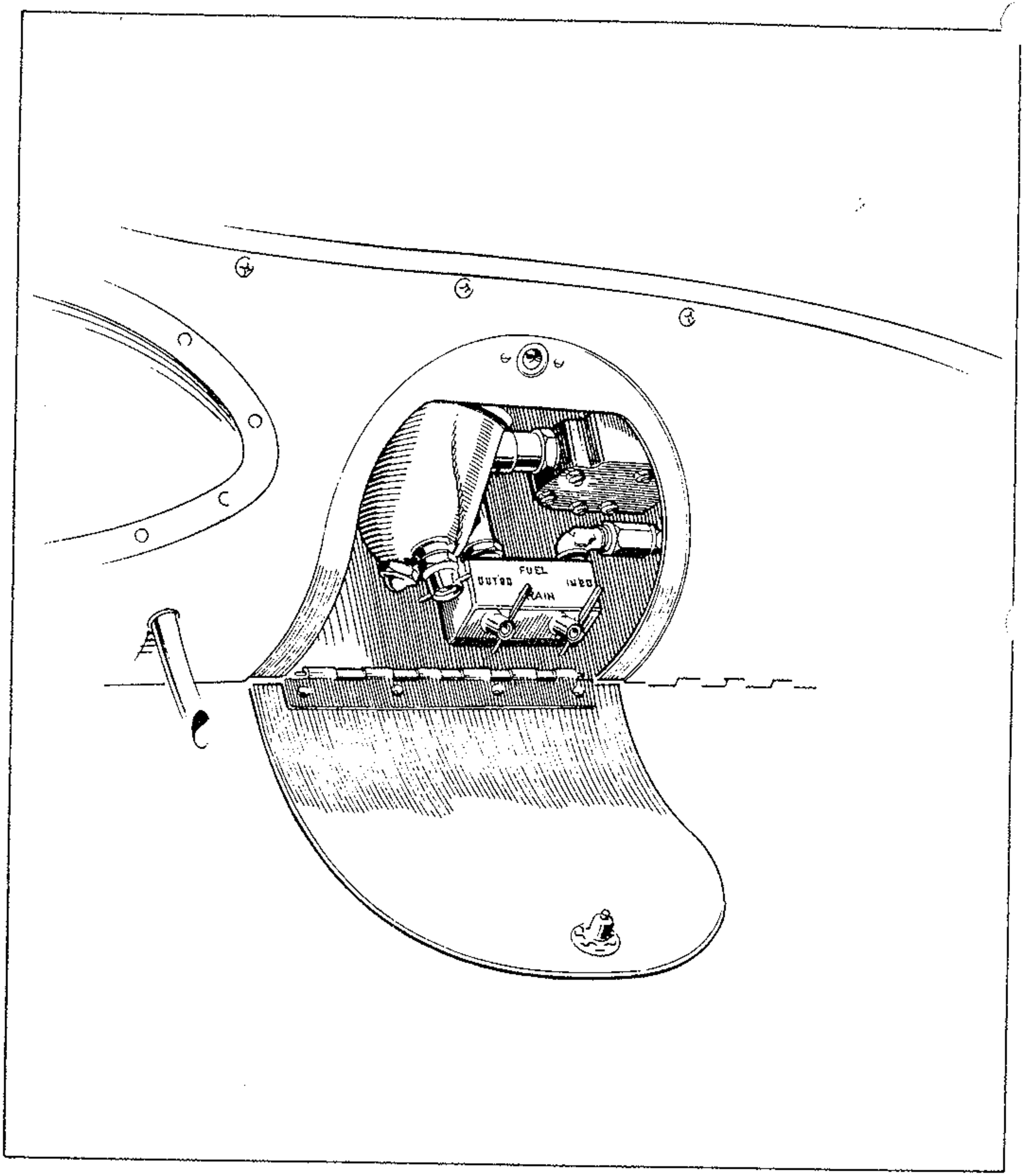
FUEL SYSTEM SCHEMATIC (NORMALLY ASPIRATED)

Figure 7-9



FUEL CONTROLS

Figure 7-11



FUEL DRAINS

Figure 7-13

7.27 ELECTRICAL SYSTEM

Electrical power for the Aztec F is supplied by a 28 volt, direct current, negative ground electrical system. The system includes a 24 volt battery enclosed in a stainless steel battery box, two 28 volt 70 ampere alternators, starters, voltage regulators and an ammeter.

The primary electrical source is the two alternators. Each alternator is controlled independently by its own voltage regulator. These voltage regulators are interconnected electrically to provide parallel output from their associated alternators within normal operating RPM ranges.

The 24 volt battery, located in the nose section of the airplane, is the secondary source of electrical power. It provides current for starting engines, for operation of electrical equipment when the engines are not running, and for electrical power to back up the alternators. The battery is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

The master switch, located on the far left of the lower instrument panel, is a split rocker type switch which gives the pilot separate control over the right and the left alternator field circuits. Should one alternator field circuit become inoperative, its corresponding section of the master switch can be turned off, and if the electrical load is reduced, electrical power for flight will be sustained by the remaining alternator.

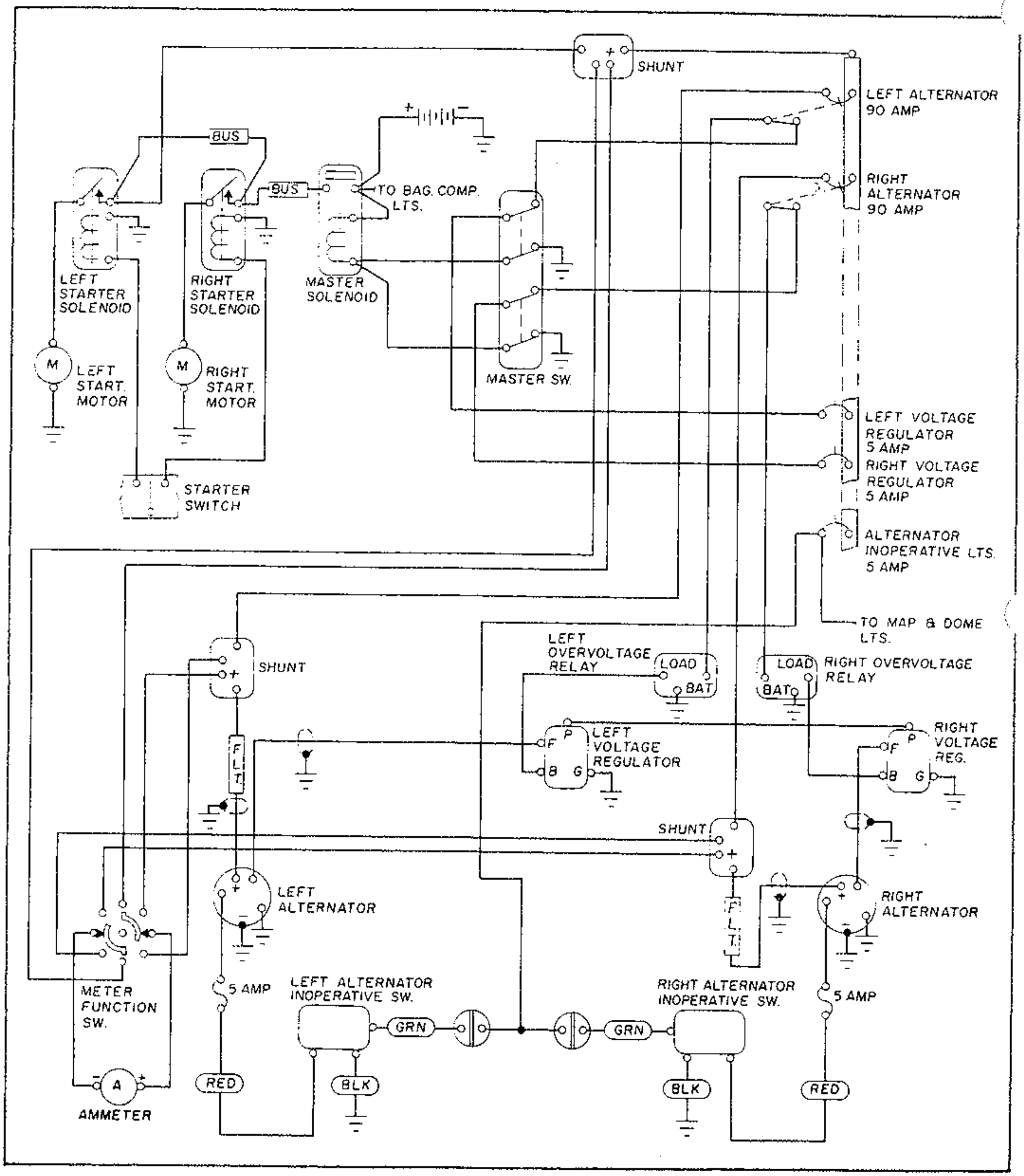
The electrical system can be monitored through the ammeter mounted on the far right of the instrument panel. The knob directly under the ammeter allows either alternator output lead or the battery to be switched onto the ammeter. When one of the alternators is not producing a voltage, its associated "Inop" warning light, below and to either side of the ammeter, will illuminate. When the master switch is turned on before the engines are started, these warning lights should illuminate. Failure to do so indicates a burnt out bulb. When the engines are operating at a high differential RPM, the alternator inoperative light for the slower engine may come on.

Electrical switches are located on both sides of the lower instrument panel. Electrical switches are of the rocker type and are internally lighted for night flight. All switches and circuit breakers are clearly labeled as to their function.

The electrical system and equipment are protected by the circuit breakers on a panel located at the far right of the lower instrument panel. Circuit breakers are of the press to reset type. If a circuit is overloaded, the breaker will pop, opening the circuit. Before a breaker is reset, the electrical load on the circuit should be reduced, and the breaker allowed to cool. Pressing in on the open breaker will reset the circuit. Continual circuit breaker popping indicates a need for corrective action. Pulling out manually on a reset button will trip a circuit breaker. The alternator circuit breakers, located just inboard of the circuit breaker panel, are of the toggle switch type and should never be turned off when the alternators are operating normally.

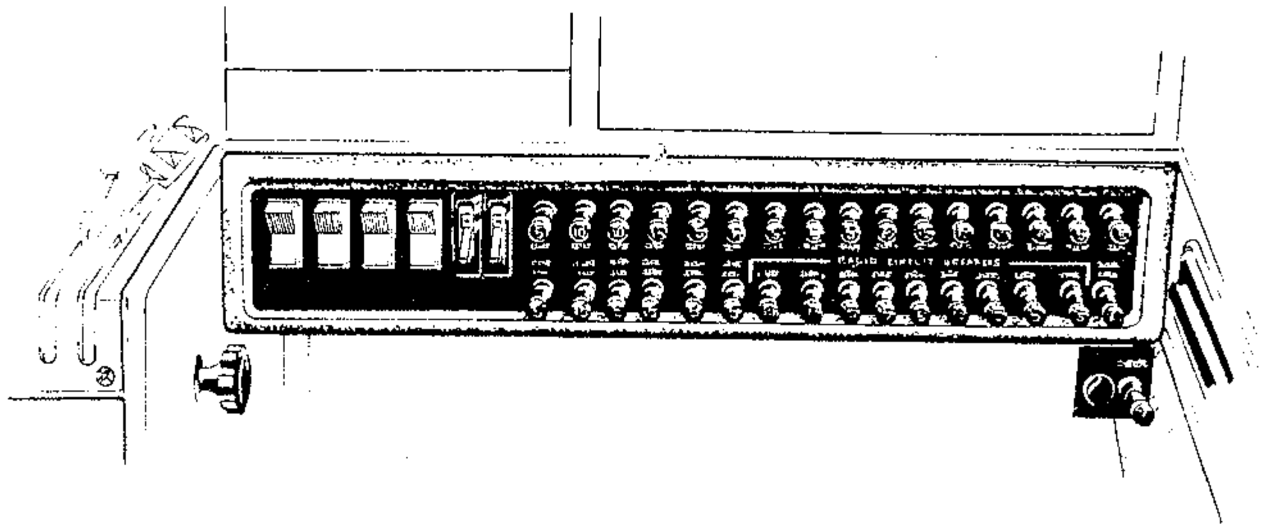
If both alternators fail in flight and the condition cannot be corrected, the airplane battery becomes the only source of electrical power. In this situation, all unnecessary electrical equipment should be turned off and the flight should be terminated as soon as possible.

The starter and magneto switches are on the left side panel. There are two magneto switches for each engine. The starter switch is of the momentary rocker type, which returns to the neutral or off position after a starter is activated.



ALTERNATOR - STARTER SCHEMATIC

Figure 7-15



CIRCUIT BREAKER PANEL

Figure 7-17

Instrument panel lighting is furnished by individual post lights mounted on the panel adjacent to each instrument. These lights are turned on or off and brightened or dimmed with the rheostat switch located on the overhead panel. Back lighting for the electrical switches and the engine gauge cluster are also controlled with the overhead panel switch. The overhead panel also contains switches for the trim indicator lights, the avionics lights, and the dome light. Overhead, just aft of the windshield, on both the right and the left sides, are map lights. Each light is operated by a switch located adjacent to the unit. An overhead dome light is mounted in the center of the cabin ceiling, and reading lights are installed over each seat. Each of these units is controlled with a separate switch.

Overhead lights in both the forward and the aft baggage compartments illuminate and extinguish automatically with the opening and closing of the baggage doors. As the master switch need not be on for the operation of the baggage compartment courtesy lights, leaving either baggage compartment door open for extended periods is not recommended. If either the forward baggage compartment door or the main cabin door is not completely closed and latched and the master switch is on, a red "Door Ajar" warning light on the upper right instrument panel will illuminate.

Exterior lighting includes navigation lights, anti-collision lights, a landing light, and a taxi light. The navigation and anti-collision lights are combined in the wing tip light assemblies. The right wing tip carries a green navigation light and the left wing tip, a red navigation light. Both wing tips have white anti-collision strobe lights. A white navigation light is installed on the vertical tail. The landing light is recessed into the underside of the nose cone. The taxi light is attached to the nose gear and moves with the nose gear to illuminate the taxi path. Should the taxi light switch be inadvertently left on after the gear is retracted, the bulb is extinguished automatically. Navigation lights, strobe lights, landing light and taxi light have separate control switches on the electrical switch panel.

WARNING

Anti-collision lights should not be operating when flying through cloud, fog or haze, since reflected light can produce spacial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

An external power receptacle, located in the lower right side of the nose section, is available as optional equipment. This installation allows the airplane to be started with an external 24-28 volt source. While the external source is being connected, the master switch should be turned off.

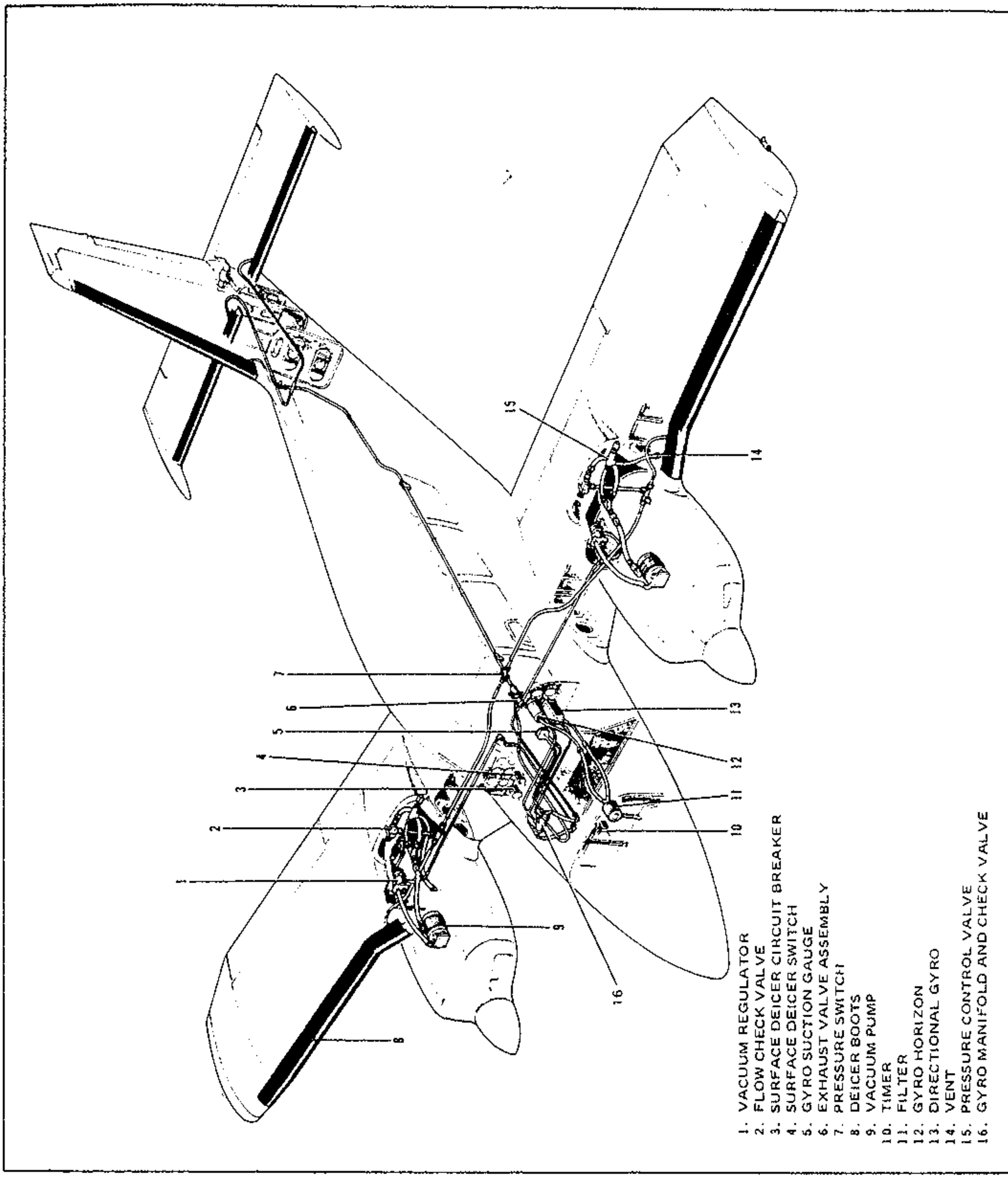
7.29 GYRO VACUUM SYSTEM

The directional gyro and the gyro horizon are instruments which indicate respectively airplane yaw to the right or left and airplane pitch and roll relative to the horizon. Both gyro instruments are air-driven by two engine mounted pneumatic pumps, one on each engine. Gyros mounted inside air tight cases are driven at high speed as vacuum from the pneumatic pumps lowers the pressure in the air tight cases and atmospheric air pressure enters to spin the gyros. Due to gyroscopic inertia, the axis of the gyro remains the same regardless of the position of the airplane. The gyro instruments indicate the position of the airplane relative to the stationary position of the rotating gyros.

The rotation of the directional gyro is stabilized in the vertical plane. When set to agree with the airplane's magnetic compass, the rotation of the directional gyro continues to point in the same direction, thus providing a positive indication on the instrument dial of any deviation of the nose of the airplane from a straight course. The gyro horizon operates on the same principal; however, the rotation of its gyro is stabilized in the horizontal plane. When the miniature adjustable airplane figure in the face of the instrument, representing the airplane, aligns with the horizontal bar across the instrument, representing the horizon, zero pitch and zero roll are indicated. A deviation in alignment represents the actual deviation of the horizontal attitude of the airplane from the true horizon.

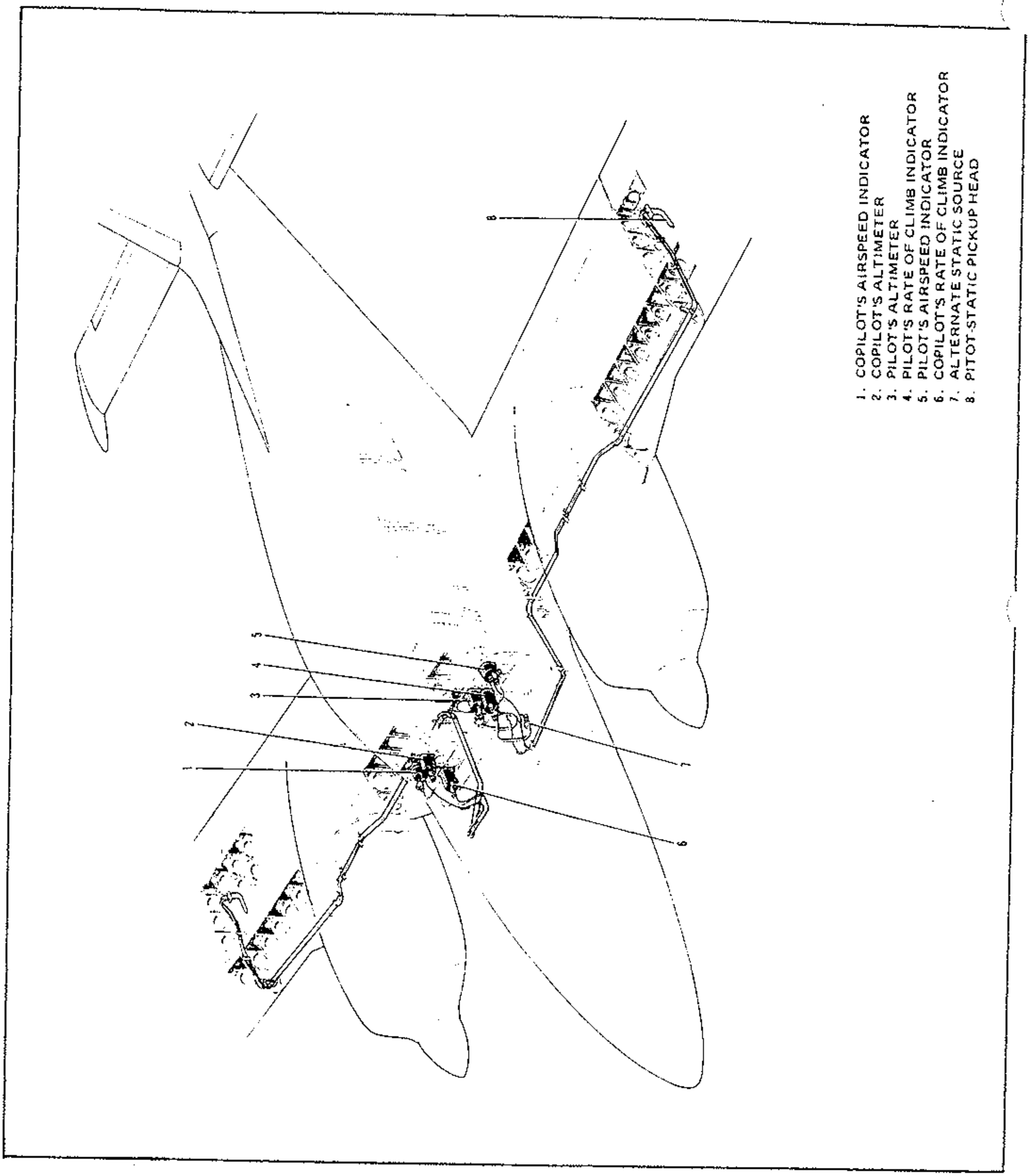
Air entering the gyro instruments is filtered. Either of the pneumatic pumps is capable of maintaining a vacuum sufficient to operate the system should the other pump fail. Optional copilot gyro instruments may be added to the system, and when optional pneumatic surface deicers are installed, they are operated through this pneumatic system.

A gyro suction gauge on the left instrument panel just inboard of the control column is calibrated in inches of mercury and indicates the amount of vacuum produced by the engine-driven pneumatic pumps. When the system is functioning properly, the gauge should indicate between 4.8 and 5.1 inches of mercury. Should either side of the system fail, a small red button will protrude from the corresponding side of the face of the vacuum gauge. The electrically operated turn coordinator may be used to verify proper function of the electrical gyros and as a standby in the event of a gyro instrument failure.



PNEUMATIC SYSTEM

Figure 7-19



PITOT-STATIC SYSTEM

Figure 7-21

7.31 PITOT-STATIC SYSTEM

The airspeed indicator, the rate of climb indicator, and the altimeter are operated by the pitot-static system. The pitot-static pickup head is mounted to the underside of the left wing, outboard of the engine nacelle. Dynamic and static air pressure for the operation of the airspeed indicator are picked up by the pitot-static head and carried through lines to the instrument. A diaphragm within the airspeed instrument is vented to the pitot source, and the instrument case is vented to the static source. As the speed of the airplane changes, pitot air pressure expands the diaphragm proportionally, and the airspeed indication is based on the differential pressure between the pitot and the static air pressure. The instrument is calibrated in knots. Some of the operating ranges and limitations are marked on the face of the dial.

The rate of climb indicator measures the rate of change in static air pressure as the airplane ascends or descends. The pointer and dial indicate in feet per minute the rate at which the airplane is climbing or descending.

The altimeter indicates barometric altitude in feet above sea level when properly set-up. The long pointer on the dial scale is read in hundreds of feet; the middle pointer, in thousands of feet; and the short pointer, in ten thousands of feet. The instrument case is vented to the static air source, and as static air pressure increases or decreases, altitude is indicated on the dial. Altitude, shown on the dial, and barometric pressure, shown in the window in the indicator dial, can be set with the knob on the lower left corner of the instrument.

An optional pitot-static pickup system and the associated lines and instruments may be installed on the right side of the airplane when copilot instruments are installed. The pitot heat switch, located on the electrical switch panel to the right of the engine controls, should be turned on when ice or heavy rain threaten to block the pitot-static pickup head. An optional alternate static air source can be installed on the control pedestal, below the hydraulic hand pump. When the alternate static source valve is open, the pilot's airspeed, rate of climb, and altitude instruments will be operating on static air from within the fuselage. When the alternate static source is selected, instrument readings may vary from readings under normal pitot-static operation.

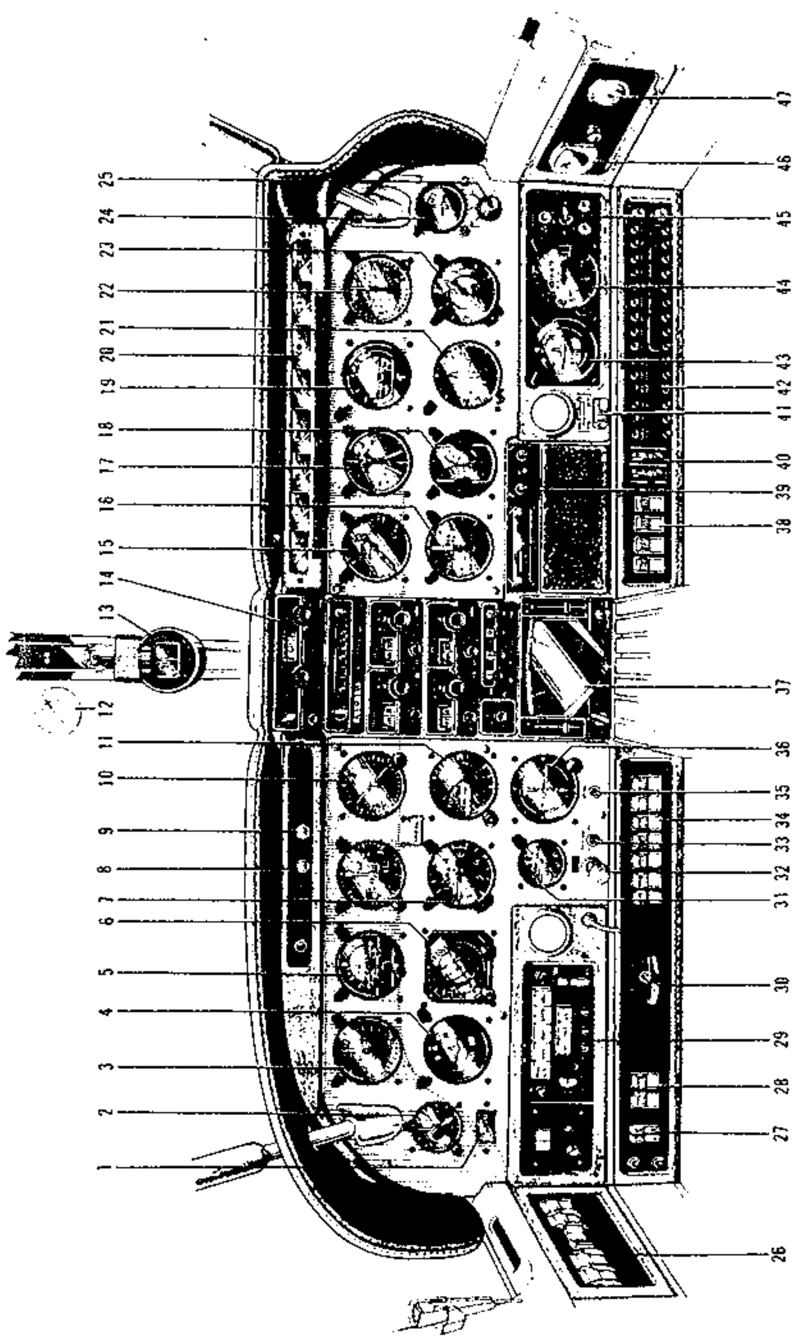
7.33 INSTRUMENT PANEL

The instrument panel of the Aztec F is designed to accommodate a full complement of advanced flight instruments, engine instruments, and navigational and communication equipment. All instruments, both standard and optional, are conveniently arranged for the most effective monitoring and operation.

The flight instrument group, situated directly in front of the pilot, includes the airspeed indicator, the altimeter, the rate of climb indicator, the turn and bank indicator, and the directional and attitude gyro instruments. Optional flight instruments, when installed either as additions or substitutions, are also mounted on the pilot's instrument panel. The copilot's instrument panel may include an optional installation of duplicate flight instruments.

The engine instrument group, located on the inboard side of the right instrument panel, includes a tachometer, fuel flow and manifold pressure gauges, and the exhaust gas temperature gauge. These are dual gauges which simultaneously monitor both engines.

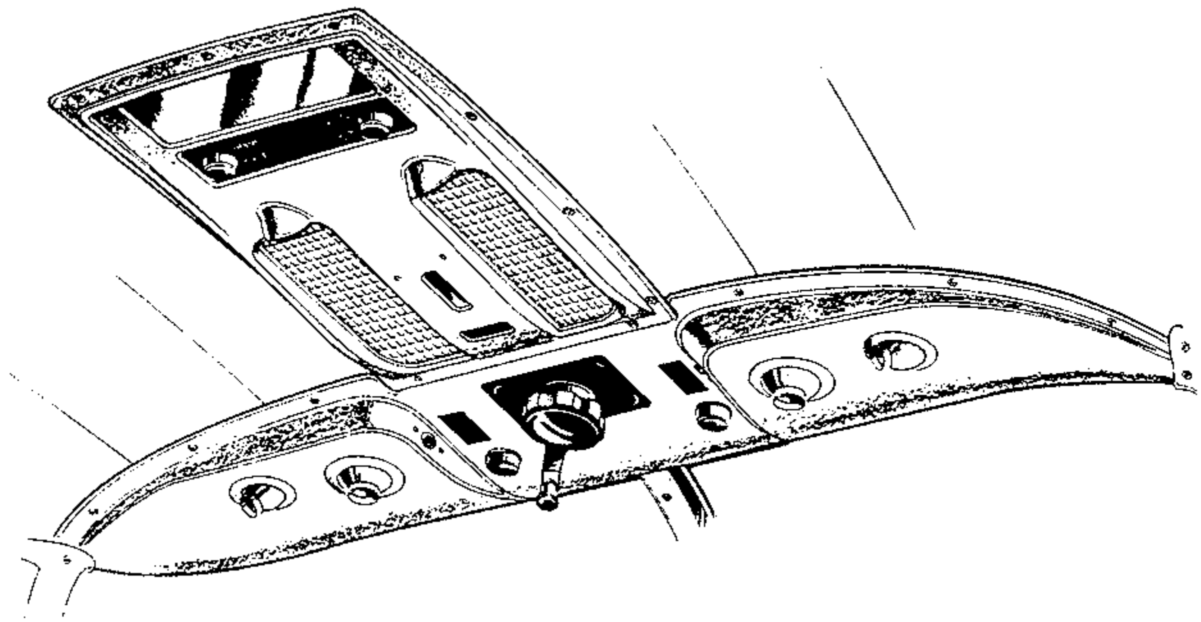
An engine gauge cluster is mounted along the upper portion of the right instrument panel. Gauges in this cluster include fuel quantity gauges, one for each side of the fuel system, and oil pressure gauges, oil temperature gauges, and cylinder head temperature gauges for each engine.



1. HOUR METER
2. CLOCK
3. AIRSPEED INDICATOR
4. TURN COORDINATOR
5. ATTITUDE GYRO
6. HORIZONTAL SITUATION INDICATOR
7. RATE OF CLIMB INDICATOR
8. GLIDE SLOPE ENGAGED LIGHT
9. DOOR AJAR LIGHT
10. ADF INDICATOR
11. RADAR ALTIMETER
12. OUTSIDE AIR TEMP. GAUGE
13. COMPASS
14. RADIO PANEL
15. TACHOMETER
16. MANIFOLD PRESS. GAUGE
17. FUEL FLOW GAUGE
18. EGT GAUGE
19. ATTITUDE GYRO
20. ENGINE GAUGES
21. DIRECTIONAL GYRO
22. AIRSPEED INDICATOR
23. ALTIMETER
24. AMMETER
25. ALTERNATOR OUTPUT SELECTOR SWITCH
26. STARTER AND MAGNETO SWITCHES
27. MASTER SWITCH
28. A/P NAV AND ELECTRIC TRIM SWITCHES
29. AUTOPILOT CONTROL PANEL
30. PARKING BRAKE
31. GYRO SUCTION GAUGE
32. CIGAR LIGHTER
33. RADAR ALTIMETER SWITCH
34. LEFT ELECTRICAL SWITCH PANEL
35. AVIONICS MASTER SWITCH
36. VOR/GLIDE SLOPE INDICATOR
37. RADAR
38. RIGHT ELECTRICAL SWITCH PANEL
39. DME
40. ALTERNATOR CIRCUIT BREAKER SWITCHES
41. EMERGENCY AVIONICS BUS POWER SWITCH
42. CIRCUIT BREAKER PANEL
43. TURN COORDINATOR
44. RATE OF CLIMB INDICATOR
45. HEATER CONTROLS
46. PROP DE-ICE AMMETER
47. OXYGEN OUTLET

TYPICAL INSTRUMENT PANEL WITH OPTIONS

Figure 7-23



OVERHEAD PANEL

Figure 7-25

Various warning lights and gauges are mounted on the instrument panel. A "Door Ajar" warning light and a glide slope engaged warning light, when this optional feature is installed, are located on the upper left of the instrument panel. The dual suction gauge which monitors the operation of the vacuum system is mounted on the left instrument panel, inboard of the control column. The ammeter and selector knob for monitoring the right or left alternator and the battery are located on the extreme right of the instrument panel.

The eight day clock is at the extreme left of the pilot's panel, and above it is an engine hour meter. Options such as autopilot controls, an avionics master switch, and a radar altimeter switch are mounted on the pilot's instrument panel below the flight instruments. The combustion heater switch is on the right instrument panel, above the circuit breaker panel.

Electrical switches controlling navigation and taxi lights, fuel pumps, pitot heat, deicers, and various other electrical functions, both standard and optional, are located on the sub-panel. The airplane master switch, the parking brake, and mike and earphone jacks are also located on the sub-panel. The section on the right side of the sub-panel holds the circuit breakers.

Radio and radar installations are mounted in the center of the instrument panel. The magnetic compass is attached to the windshield centerpost, above the instrument panel.

Illumination for night flight is provided by post lights on each instrument and by backlighting for the electrical switches, engine gauges, and avionics equipment. Post lights and backlights are turned on or off and brightened or dimmed with two separate rheostat switches mounted on the overhead panel above the crew seats.

7.35. RADIO EQUIPMENT

A variety of radio options may be installed in the Aztec F. Radio controls are mounted in the center portion of the instrument panel. Microphone and earphone jacks are located on both sides of the instrument panel, and a cabin speaker is included in the overhead panel. Radio light intensity is controlled by a rheostat switch on the overhead panel.

Power supplies for the various radio installations are located on a shelf at the rear of the forward baggage compartment. The attachment of anti-static wicks to trailing edges of the airplane clears the airplane of any surface static electricity which might cause radio interference.

On airplanes with serial numbers 27-7754094 and up, an Emergency Avionics Bus Power switch is located on the instrument panel directly below the copilot control wheel. This switch is protected from inadvertent activation by a red switch guard. During normal operating conditions, the switch is in the OFF position and the guard is closed. If avionics power is lost while the avionics master switch is ON and the avionics circuit breakers are in, turn OFF the avionics master switch. Open the switch guard and turn ON the switch, up to 50 amps is available. Use of the Emergency Avionics Bus Power switch should be limited to the above described condition and not activated under any other circumstances.

7.37 RADAR*

A weather radar system can be installed in the Aztec F. The basic components of this system are an antenna, a transmitter/receiver, and a cockpit indicator. The function of the weather radar is to detect weather conditions along the flight path and to visually display a continuous weather outline on a cockpit indicator mounted in the lower center segment of the instrument panel. Through interpretation of the advance weather information given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

The operating and service manuals provided by the weather radar system manufacturer offer detailed information on the operation and adjustment of the system to its optimum efficiency.

NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest setting.

WARNING

Heating and radiation effects of radar can cause serious damage to the eyes and other tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accommodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating, direct the nose of the airplane away from buildings, large metal structures or other aircraft within a distance of 100 yards to prevent the return of reflected energy to the system. Do not operate the radar while the airplane is in a hangar or other enclosure.

*Optional equipment

7.39 HEATING, VENTILATING AND DEFROSTING

The Aztec F features two separate airflow systems for heating, ventilating, and defrosting. The first system inducts air through a scoop at the bottom of the nose section, aft of the landing light. The heating, ventilating and defrosting functions of this air are controlled by the five cabin air controls at the bottom of the control pedestal. The second system, for ventilation only, inducts fresh air through inlets in the fairing forward of the vertical tail and is controlled by two ventilation knobs on the forward cockpit ceiling and by individually adjustable outlets at each seat location. Cabin air is exhausted through the floor in the aft baggage compartment. A 35,000 B.T.U. Janitrol combustion heater installed in the nose section supplies heated air.

On aircraft with serial numbers 27-7654001 thru 27-8054059 the combustion heater uses gasoline from the left side of the fuel system when the crossfeed is off and from the selected tank when the crossfeed is on. Fuel consumed by the heater does not significantly affect the range of the airplane. The heater features an overheat lockout switch which automatically renders the heater inoperative if a malfunction causes excessively high heater temperature. This safety device has a reset button, which is mounted on the heater shroud and can be reached only through the access panel on the left side of the nose section. The combustion heater is controlled by a three-position cabin heat control switch on the far right of the instrument panel.

On aircraft with serial numbers 27-8154001 and up the combustion heater uses gasoline from the left side of the fuel system when the crossfeed is off and from the selected tank when the crossfeed is on. Fuel consumed by the heater does not significantly affect the range of the airplane. The combustion heater is controlled by a three-position cabin heat control on the far right of the instrument panel. An amber colored indicator/switch is located adjacent to the heater controls and is placarded HEAT-OV/TEMP - Push to RESET. The indicator and the switch are a single unit. In the event that over-temp. condition would occur, an automatic reset thermal switch loaded on the heater will trip a relay which in turn will remove electrical power from the heater and illuminate the HEAT OV/TEMP indicator light. The pilot will be able to reset the heater by pushing the reset switch after the heater has cooled sufficiently to allow the thermal switch to reset.

CAUTION

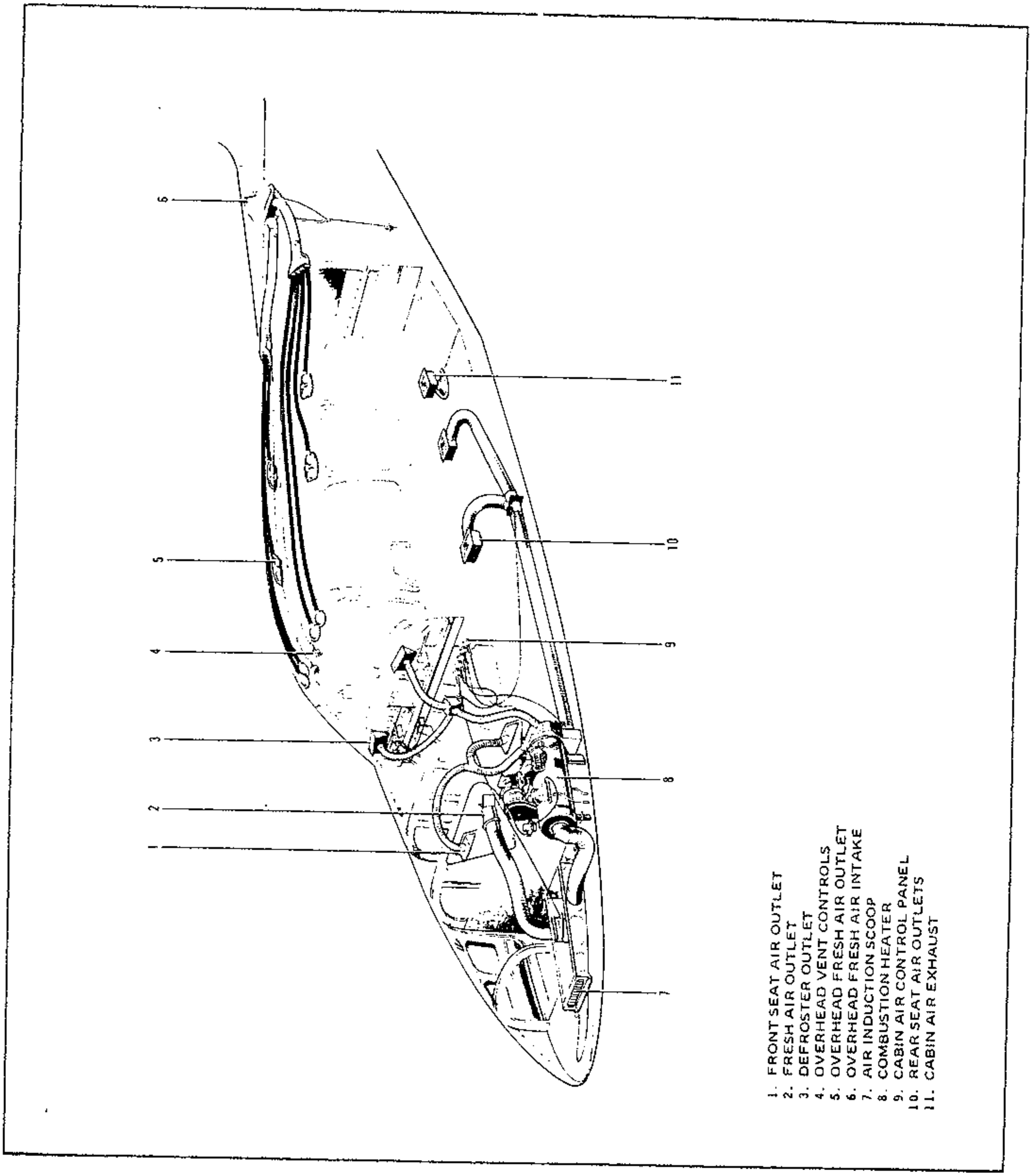
This switch should only be used one time per flight. Continuous tripping of the overheat switch indicates a failure in the heating system.

The five cabin air control knobs are operated by push-pull movement. The left knob regulates airflow through the bulkhead to the front seat; the second knob from the left regulates airflow through floor vents to the rear seats. This air, as well as defroster air, enters the nose scoop and passes through the combustion heater, and it may be either cool or heated, depending upon the position of the cabin heat control switch.

The center knob on the cabin air control panel regulates the combustion heater thermostat. As it is pulled out or pushed in, cabin heat increases or decreases respectively. This control functions only when the cabin heat control switch is turned on.

The second knob from the right controls airflow to the windshield through the defroster vents. Airflow to the windshield increases as the knob is pulled out. In the event of severe windshield fogging or icing, it may be necessary to drive more air to the defrosters by closing or partially closing the front and rear seat airflow controls.

The knob on the right of the cabin air control panel supplies cold outside air directly from the nose scoop to the front seat through a vent in the bulkhead, bypassing the heater. All five of these control knobs may be set at any intermediate position from fully open to fully closed.



HEATING, VENTILATING AND DEFROSTING SYSTEM

Figure 7-27

The three position of the cabin heat control switch are "Heat," "Fan," and "Off." When the switch is off, all air entering the cabin will be cool outside air. The fan position activates the fan in the combustion heater without igniting the heater. This function allows cool air to be circulated through the cabin while the airplane is at rest on the ground. It is advisable to place the switch in the fan position for several minutes after the heater has been operating to allow the unit to cool down before its turned off. The heat position activates the combustion heater. When the switch is in the heat position, the combustion heater will ignite as required to maintain the temperature set on the thermostat. To warm the cabin before flight, the master switch and the left electric fuel pump may be turned on and the cabin heat control placed in the heat position. If should be noted, however, that prolonged operation in this manner will deplete the battery.

The two master controls for the overhead ventilating system are located just above the windshield. Turning a control knob counterclockwise regulates airflow to the respective side of the system. Ventilation at each seat may then be controlled individually with the adjustable fresh air outlets in the ceiling above each seat.

Cabin temperature and air circulation may be maintained within a comfortable range by using ventilation and heat controls in various combinations.

7.41 SURFACE DEICING SYSTEM*

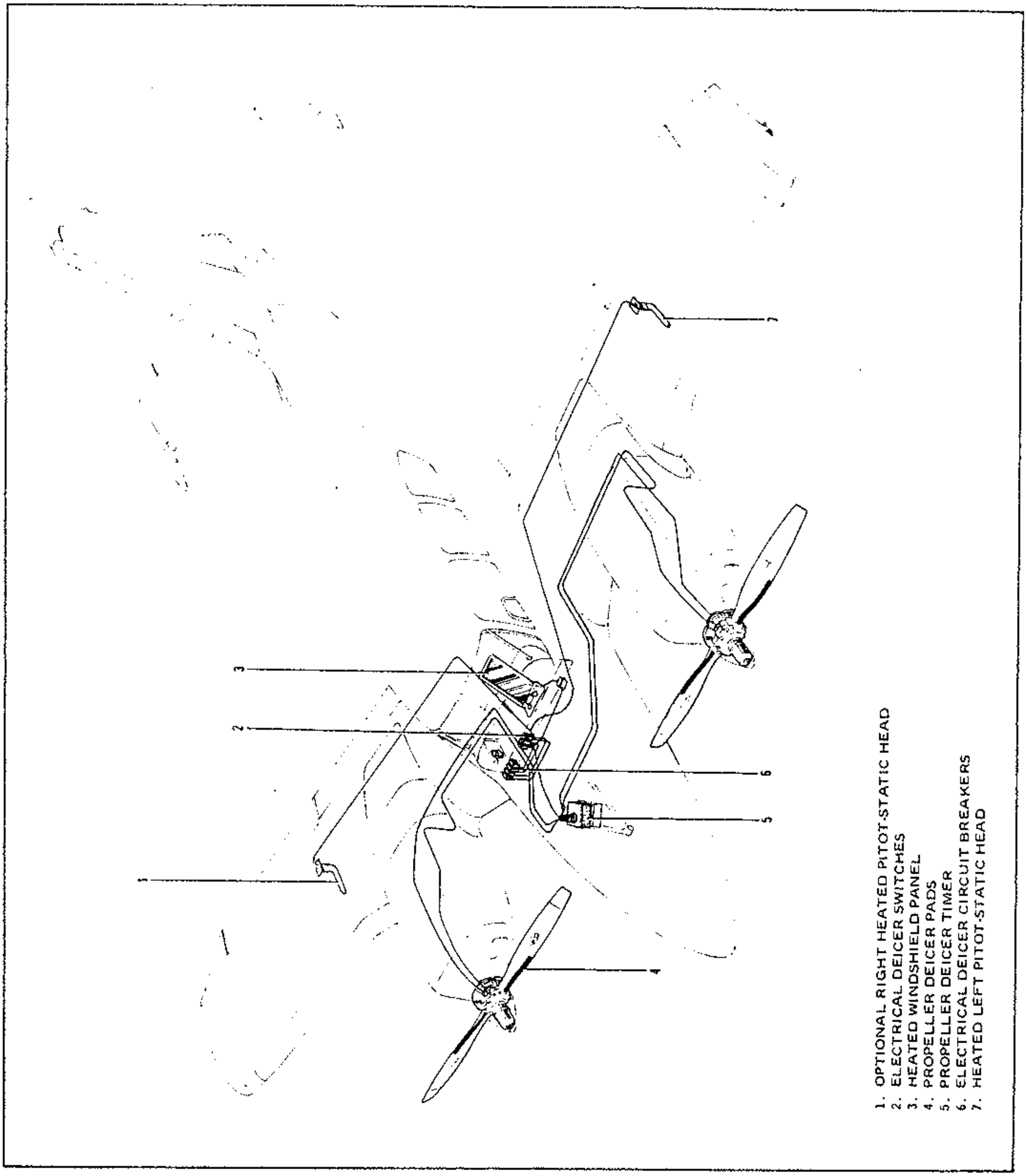
The Aztec F may be equipped with optional ice protection devices which will enable it to be flown in light to moderate icing conditions.

The optional pneumatic surface deicers are installed on the leading edges of the wings, the stabilator, and the vertical tail. Air pressure for the inflation of the deicer boots is supplied by the engine-driven pneumatic pumps. During normal operation, when the surface deicer system is turned off, constant suction is applied to the deicer boots to provide smooth, streamlined surfaces on the leading edges.

The pneumatic deicers are controlled by a "momentary on" type switch labeled "Surface Deice." Once this switch on the electric switch panel is activated, the boots complete one inflation cycle. The switch must be reactuated for each additional cycle. This allows the pilot to manually select boot inflation in any time interval as required. After the inflation cycle is completed, the system timer automatically resets, preparing the system to begin another cycle when the control switch is reactuated. The deicers are most effective when operated with 1/4 to 1/2 inch of ice accumulation.

Depressing the surface deice switch activates the system cycle timer, which energizes the pneumatic pressure control valves, allowing pneumatic pump pressure to inflate all pneumatic deicer boots for 7.5 seconds. When the cycle is complete, deicer solenoid valves permit automatic overboard exhaustion of the pressurized air. Suction is then applied to the boots. A blue indicator light, located on the right side panel, illuminates when pressure in the deicer boots is in excess of 10 psi. During the inflation cycle, the light should illuminate, and when the cycle is complete, it should extinguish. Contrary operation of the indicator light may indicate a failure in the pneumatic deicer system. A press-to-test feature allows the bulb to be tested.

*Optional equipment



ELECTRICAL DEICING SYSTEM

Figure 7-29

7.43 ELECTRIC PROPELLER DEICERS*

Optional electrothermal propeller deicer pads are bonded to the leading edges of the propeller blades. Each deicer pad has two separate heating elements, one for the inboard and one for the outboard half.

The propeller deicer system is controlled by an "on-off" type switch on the electric switch panel labeled "Prop Deice." When the switch is actuated, power is supplied to the system timer. Power from the timer is cycled in turn to brush assemblies which distribute power to modified starter ring gears incorporating slip rings. Current is then supplied from the slip rings directly to the propeller deicer pads. A propeller deicer ammeter mounted on the right side panel is connected in series between the switch and the timer to monitor the current through the system. When the propeller deicing system is on, the ammeter needle should be within the green arc on the face of the dial for a normal reading.

The heat of the deicer pads reduces the adhesion between the ice and the propeller. Centrifugal force and the blast of the airstream then cause the ice to be thrown from the propeller blades in very small pieces.

The system timer controls the heating sequence of the deicer pads in the following cycle:
(a) Outboard halves of propeller deicer pads on right engine (30 seconds).
(b) Inboard halves of propeller deicer pads on right engine (30 seconds).
(c) Outboard halves of propeller deicer pads on left engine (30 seconds).
(d) Inboard halves of propeller deicer pads on left engine (30 seconds).

When the system is turned on, heating may begin on any one of the above steps, depending upon the position of the timer switch when the system was turned off from previous use. Once activated, cycling will proceed in the above sequence and will continue until the system is turned off.

A preflight check of the propeller deicers can be accomplished by turning on the prop deice switch and feeling the pads for the proper heating sequence. During this static test, the system should be operated no longer than through two complete cycles.

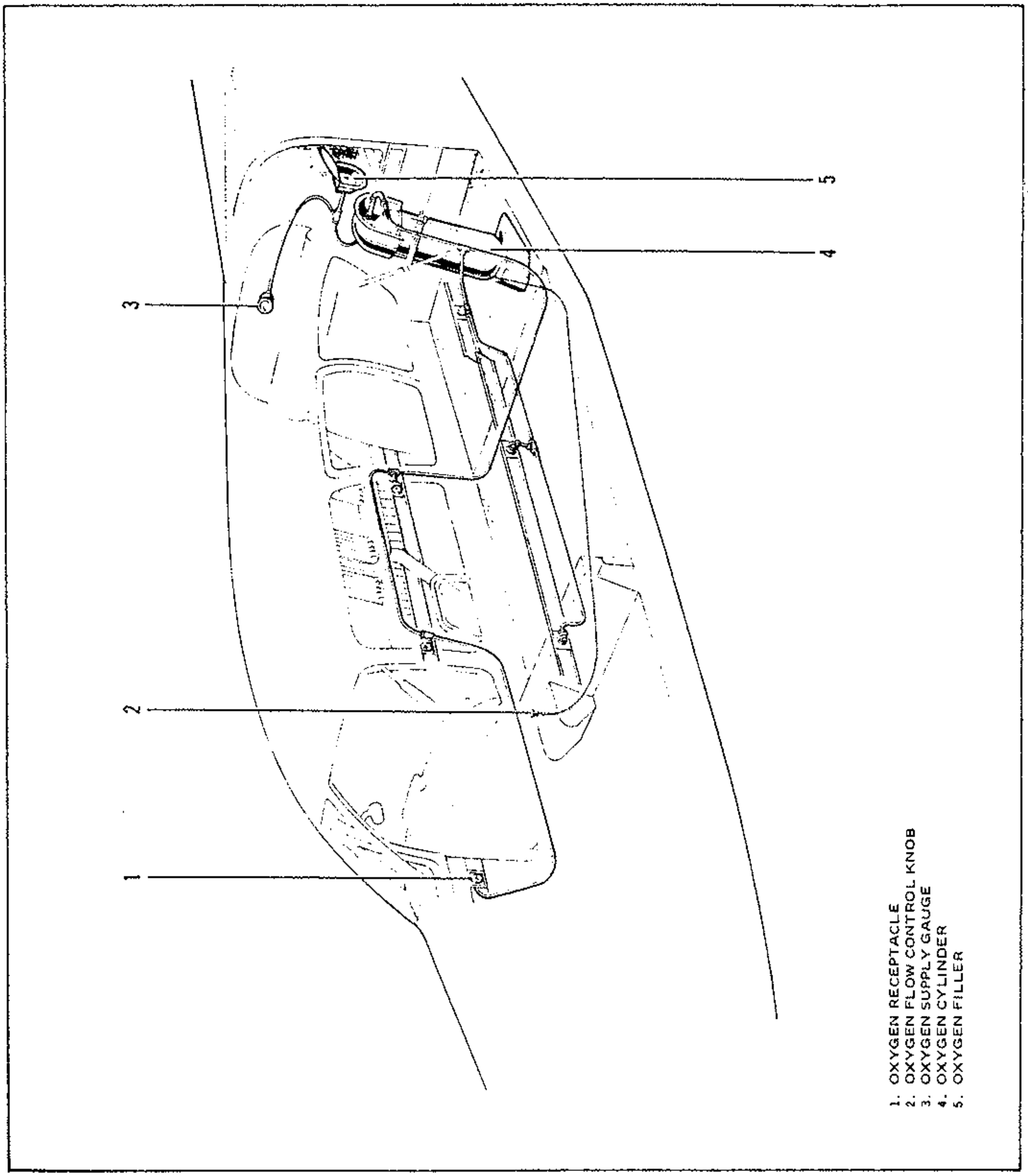
7.45 HEATED WINDSHIELD PANEL*

An optional heated glass panel may be installed on the exterior of the pilot's windshield to allow visibility in icing conditions. When the switch on the electrical switch panel labeled "Windshield Heat" is turned on, electrical current is supplied to heating elements imbedded in the panel. Unless the airplane is in flight or there is an accumulation of ice on the panel, the unit should not be turned on for a period exceeding thirty seconds.

An operational check of the heated windshield panel may be performed by turning the windshield heat switch on for a period not exceeding thirty seconds and insuring that the panel is warm to the touch.

Prior to flight in conditions where ice might be encountered, it should be ascertained that the heated panel is securely attached and that the lead wire plug is firmly inserted in the socket provided. To facilitate windshield cleaning, the heated panel is hinged at the bottom.

*Optional equipment



OXYGEN SYSTEM

Figure 7-31

7.47 OXYGEN SYSTEM*

An oxygen system to provide supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet) is available in the Aztec F as optional equipment. The major components of the Scott oxygen system are a 115 cubic foot oxygen cylinder, an oxygen supply gauge, a flow control knob, a pressure regulator, and six plug-in receptacles.

The oxygen cylinder is mounted forward in the aft baggage compartment. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen supply gauge is mounted in the aft cabin bulkhead, above and to the center of the rear seat. The oxygen flow control knob, labeled "Pull-On" is mounted on the fuel management control console between the front seats. The pressure regulator is mounted directly on the oxygen cylinder. Once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the access door aft of the rear window on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed (refer to Figure 7-32). When oxygen is required, the control knob should be pulled up to the on position, allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it clockwise 90 degrees automatically releases oxygen flow to the mask through the on-off valve feature of the receptacle. The occupant then dons the mask and breathes normally for a sufficient supply of oxygen.

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen use is essential, the airplane should be lowered to a safe altitude immediately.

When not in use, masks may be stowed in the storage pockets behind the front and center seats. Always remove fittings from the oxygen receptacles and stow the masks when they are not in use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

The pilot and copilot masks, identified by a red band on the supply hose, supply 120 liters of oxygen per hour; the passenger masks, identified by a gold band on the supply hose, supply 90 liters of oxygen per hour. In some cases, depending upon mask options installed, the oxygen flow of passenger masks may vary.

CAUTION

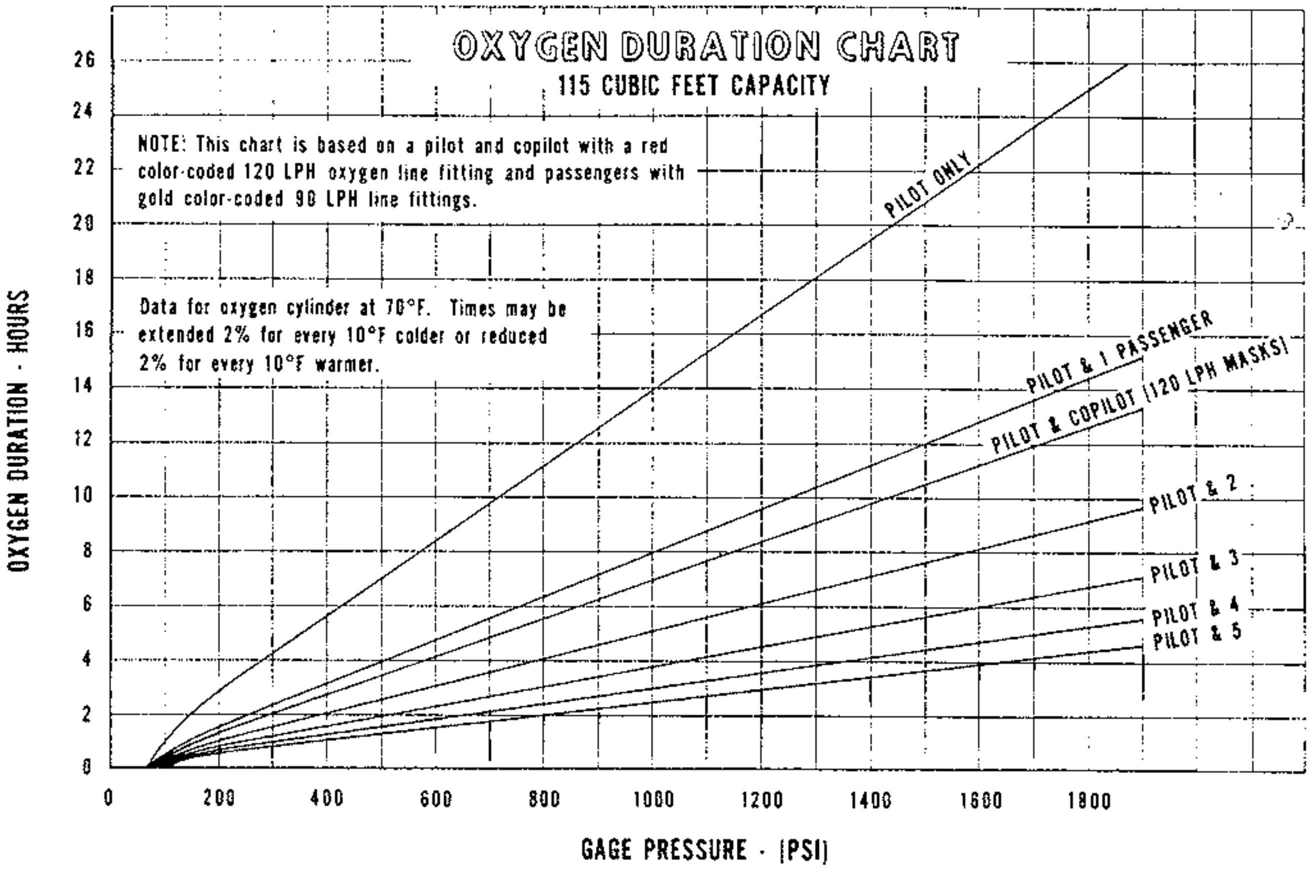
Positively NO SMOKING while oxygen is being used by anyone in the airplane.

To stop the flow of oxygen through the system, the control knob should be pushed down to the off position. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

After each use, permanent type oxygen masks should be cleaned, and disposable type oxygen masks should be replaced.

*Optional equipment



OXYGEN DURATION CHART

Figure 7-32

7.49 SEATS

Standard six-place seating in the Aztec F includes individual bucket seats for the crew and the two center passengers and a couch-type rear seat. All seats are removable to accommodate cargo loads. The bucket seats are removed by detaching the stop plates from the seat tracks and then sliding the seats forward or aft as required to disengage the seat supports from the tracks. The rear seat back is removed by pulling it forward and lifting it out; the seat portion is removed by pulling it forward to disengage the pins at the rear and then pushing it rearward to disengage the seat supports from the floorboards.

Both crew seats and both center seats are adjustable fore and aft. The front seat releases are horizontal bars under the seats, and the center seat releases are levers projecting from the center front of the seats, just below the cushions. All four bucket seat backs tilt forward for ease of entry and exit, and all four backs recline to three positions by use of the levers on the sides of the seats.

All seats are equipped with headrests and safety belts with shoulder harnesses. The four forward seat backs incorporate large storage pockets. The seats are comfortably cushioned with foam rubber and are upholstered in a choice of fabric, Naugahyde, or leather. Cleaning procedures should suit the upholstery material installed.

7.51 CABIN FEATURES

Cabin appointments are designed for maximum comfort and convenience. The cabin sound level is reduced by thick fiberglass insulation and double-paned windows. Sun visors over the windshield and curtains on the side windows provide crew and passengers with glare protection.

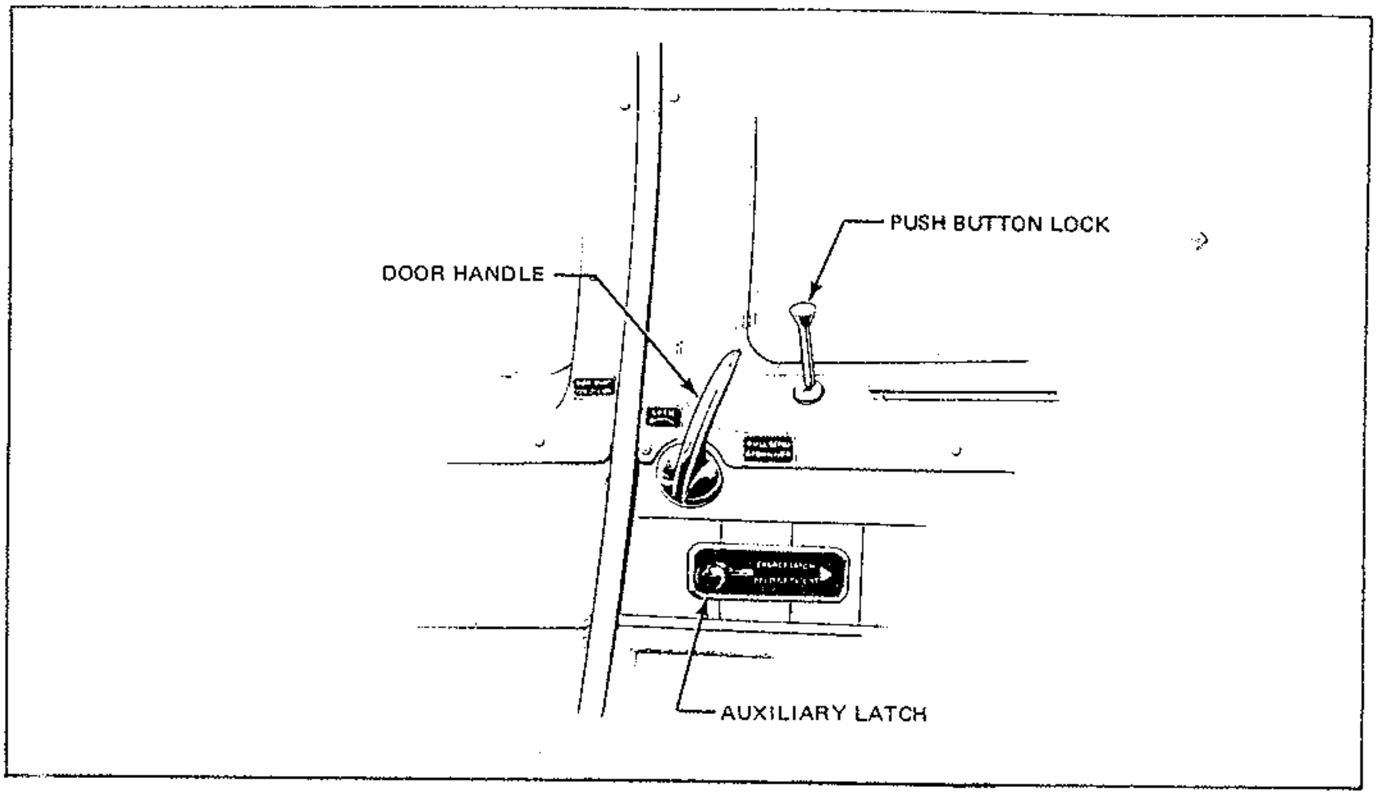
The pilot's side window incorporates a storm window which opens inward. A cigar lighter is installed on the pilot's instrument panel.

CAUTION

Do not use a cigar lighter receptacle as a power source for any devices other than the cigar lighter supplied with the airplane. Damage may result if any other devices are plugged into the cigar lighter receptacle.

There are two overhead map lights for the crew and each passenger seat is provided with a reading light. All six seat locations include armrests, ash trays, individual ventilation controls, and seat belts with shoulder harnesses. Removable armrests on the crew seats may be stowed in scabbards on the outboard foot wells when not in use.

Since shoulder harnesses are equipped with self-adjusting inertia reels, they will extend or retract with normal movement, allowing the seat occupant freedom of movement. Under a sharp forward force, the inertia reel will lock in place. This locking feature prevents the harness from extending and holds the seat occupant in place. Operation of the inertia reel can be checked by tugging sharply on the shoulder strap; the reel should lock, preventing the strap from extending. Shoulder harnesses should be routed over the shoulder nearest the window and secured when the lap belt is latched. Safety belts should be routinely worn during all takeoffs and landings and in emergency situations.



CABIN DOOR LATCHES

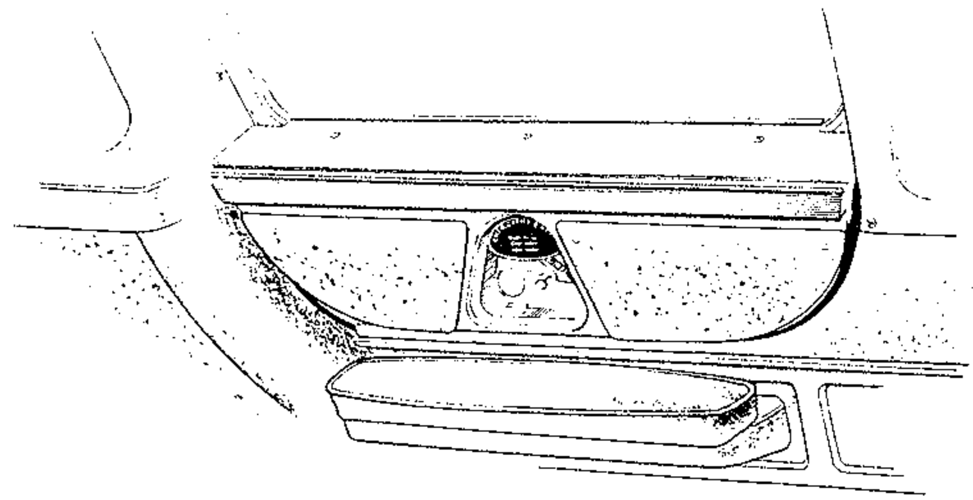
Figure 7-33

Additional cabin features include assist straps, coat hangers, and individual oxygen outlets when the oxygen system is installed. The cabin door opens wide for ease of entry and exit. The inside door handle and the push-button inside lock should be engaged during flight. When both the handle and the button are properly positioned the door cannot be opened inadvertently. The auxiliary latch must be engaged during all flight operations. There is an anti-theft key lock on the outside of the cabin door.

An emergency exit window is installed in the left side of the fuselage, adjacent to the left center seat. The window is sealed when installed and should be used only in emergencies. The emergency exit is operated by removing the plastic handle guard and turning the handle. The window may then be pushed outward away from the fuselage with a steady sustained pressure on the bottom sill.

7.53 BAGGAGE COMPARTMENTS

There are two separate baggage compartments in the Aztec F, each with a capacity up to 150 pounds. The forward compartment, accessible through a 19.5 x 30.5 inch door in the right nose section, has a volume of 21.3 cubic inches. The aft baggage compartment, accessible through a 30 x 31 inch door aft of the right side windows, has a volume of 26.2 feet. Both baggage compartment doors are key locked. Baggage tie down straps furnished in both compartments should be used for safe and secure stowage of baggage. Both baggage doors are locked with the same key.



EMERGENCY EXIT WINDOW

Figure 7-35

NOTE

It is the pilot's responsibility to insure that the airplane is properly loaded and that the airplane C.G. falls within the allowable C.G. range.

7.55 STALL WARNING

An approaching stall is indicated by the sounding of a stall warning horn. A lift detector on the outboard left wing activates the horn, which has a completely different sound from that of the gear up warning horn.

NOTE

Passengers unfamiliar with the airplane may be startled by a warning horn unless they are advised of the function of the horns prior to takeoff.

7.57 FINISH

All sheet aluminum components of the Aztec F are carefully finished both inside and outside to insure maximum service life. Both sides of all pieces are alodine treated and coated with zinc chromate primer before assembly. Tubular steel structures are rust proofed, zinc chromate primed, and enameled. Thus, all parts of the airplane, both structural and non-structural,are highly corrosion resistant.

The external finish of the airplane is durable high gloss acrylic lacquer, which is available in a variety of colors and color combinations to suit the taste of each individual owner. To keep the airplane looking new, economy sized touch-up spray cans of matching colors are available from Piper dealers.

7.59 NUMBER PLATES

The manufacturer's identification plate is attached to the floor of the airplane, under the carpet forward of the copilot's seat. A plate identifying only the airplane serial number is attached to the fuselage skin to the right and just forward of the tail skid. The serial number should always be used when referring to the airplane in service or warranty matters.

7.61 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is enclosed under the removable dorsal fin forward of the vertical tail attachment to the fuselage. The unit meets the requirements of FAR 91.52. The transmitter operates on a self- contained battery.

A battery replacement date is marked on the transmitter label. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter had been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

When installed in the airplane, the ELT transmits through the antenna mounted on the fuselage. The unit is also equipped with an integral portable antenna to allow the locator to be removed from the airplane in an emergency and used as a portable signal transmitter. Should it become necessary to remove the ELT from the airplane, be sure that the switch on the unit is in the "OFF" position before the transmitter is disconnected from the fuselage antenna. After the portable antenna is attached the unit may be turned "ON" as desired.

The locator should be checked during the preflight ground check to make sure that it has not been accidentally activated. Check by turning a radio receiver to 121.5 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Rearm the unit and then recheck.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time the tests should be coordinated with the nearest FAA tower or flight service station.

*Optional equipment

GARRETT 627810-1 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The "ARM" position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the "OFF" position. The "ARM" position should be selected whenever the unit is in the airplane. The "ON" position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the "OFF" position when changing the battery, rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the "ON" position for any reason, the "OFF" position has to be selected before selecting "ARM." If "ARM" is selected directly from the "ON" position, the unit will continue to transmit in the "ARM" position.

A pilot's remote switch, located below the hydraulic hand pump on the control pedestal allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON (RESET)," "ARM." The "ARM" position should be selected for all normal flight operations. If activation occurs with the remote switch in the "ARM" position, the transmitter must be reset by selecting the "ON (RESET)" position for one second and returning the switch to "ARM."

CCC CIR 11 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The "ARM" position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the "OFF" position. The "ARM" position should be selected whenever the unit is in the airplane. The "ON" position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the "OFF" position when changing the battery, rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the "ON" position for any reason, the "OFF" position has to be selected before selecting "ARM." If "ARM" is selected directly from the "ON" position, the unit will continue to transmit in the "ARM" position.

A pilot's remote switch, located below the hydraulic hand pump on the control pedestal, allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "ARM" (Normal Flight Position), "RESET." If the pilot's remote switch has been placed in the "ON" position for any reason, the momentary "RESET" position must be selected for 3 seconds before allowing it to return to the "ARM" position. If for any reason the impact switch becomes inadvertently activated, it may be reset by selecting the momentary "RESET" position for 3 seconds before allowing it to return to the "ARM" position.

NARCO ELT 10 OPERATION

On the unit is a switch placarded "ON," "OFF," and "ARM." The "ARM" position allows the unit to be set to the automatic mode so that it will transmit only after activation by impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the "OFF" position. The "ARM" position should be selected whenever the unit is in the airplane. The "ON" position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter. The "OFF" position should be selected while changing the battery or to discontinue transmission after the unit has been activated.

A pilot's remote switch, located below the hydraulic hand pump on the control pedestal, allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "ARM (Normal Flight Position)." The "ARM" position should be selected for all normal flight operations. If activation occurs with the remote switch in the "ARM" position, the transmitter must be reset. A button labeled "RESET" is located above the selector switch. To rearm the unit after it has been turned off or after it has been activated, the "RESET" button should be pressed in after the selector switch has been placed in the "ARM" position. This will end transmission and rearm the unit.

7.63 FIRE EXTINGUISHER (PORTABLE)*

A portable fire extinguisher is mounted to the seat frame beneath the pilot's seat. The extinguisher is suitable for use on liquid or electrical fires. It is operated by aiming the nozzle at the base of the fire and squeezing the trigger grip. Releasing the trigger automatically stops further discharge of the extinguishing agent. Read the instructions on the nameplate and become familiar with the unit before an emergency situation. The dry powder type extinguisher is fully discharged in about 10 seconds, while the Halon 1211 type is discharged in 15 to 20 seconds.

WARNING

The concentrated agent from extinguishers using Halon 1211 or the by-products when applied to a fire are toxic when inhaled. Ventilate the cabin as soon as possible after fire is extinguished to remove smoke of fumes. Use oxygen, if necessary and available.

*Optional equipment

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing and maintenance of the Aztec F.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from Piper dealers or distributors. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent by the FAA to the latest registered owner of the affected aircraft and to subscribers of the service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

Piper Aircraft Corporation provides for the initial and first 50-hour inspection, at no charge to the owner. The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies him to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO)representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Progressive Maintenance program is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 25-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used in air carrier service. The following is a list of the maintenance which the pilot may perform:

(a) Repair or change tires and tubes.
(b) Service landing gear wheel bearings, such as cleaning, greasing or replacing.
(c) Service landing gear shock struts by adding air, oil or both.
(d) Replace defective safety wire and cotter keys.
(e) Lubrication not requiring disassembly other than removal of non-structural items such as cover plates, cowling or fairings.
(f) Replenish hydraulic fluid in the hydraulic reservoirs.
(g) Refinish the exterior or interior of the aircraft (excluding balanced control surfaces) when removal or disassembly of any primary structure or operating system is not required.
(h) Replace side windows and safety belts.
(i) Replace seats or seat parts with replacement parts approved for the aircraft.
(j) Replace bulbs, reflectors and lenses of position and landing lights.
(k) Replace cowling not requiring removal of the propeller.
(l) Replace, clean or set spark plug clearance.
(m) Replace any hose connection, except hydraulic connections, with approved replacement hoses.
(n) Remove the battery and check fluid level and specific gravity.

Although the above work is allowed by law, each individual should make a self analysis as to whether he has the ability to perform the work.

If the above work is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
  (1) Aircraft Airworthiness Certificate Form FAA-1362B.
  (2) Aircraft Registration Certificate Form FAA-500A.
  (3) Aircraft Radio Station License Form FCC-404A, if transmitters are installed.

(b) To be carried in the aircraft at all times:
  (1) Pilot's Operating Handbook.
  (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
  (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be towed by use of the nose wheel tow bar stowed in the baggage area or with power equipment that will not damage or excessively strain the nose gear steering assembly.

CAUTION

When towing with power equipment, do not turn the nose gear beyond its turning radius in either direction, as this may result in damage to the nose gear and steering mechanism.

CAUTION

The nose wheel steering and rudder control systems are interconnected through the rudder pedals. Any effort to tow the airplane when the rudder control is secured may result in severe damage to the nose wheel steering mechanism and rudder control system.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures and taxiing techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following procedures should be followed:

(1) Taxi with the propeller in the low pitch, high RPM setting.
(2) When taxiing on uneven ground, avoid holes and ruts.
(3) Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside to guide the airplane.
(4) Do not operate the engines at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that might cause damage to the propeller blades.
(5) Be sure that alternate air is not being used.
(6) After taxiing forward a few feet, apply the brakes to determine their effectiveness.
(7) While taxiing, make slight turns to ascertain the effectiveness of the steering.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected against adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) When parking the airplane, head it into the wind if possible.
(2) Always chock the tires. When necessary, the parking brake can be set by applying pressure to the toe brakes at the top of the rudder pedals while pulling out on the parking brake handle just below the left control column. To release the parking brake, apply toe pressure to the pedals and push in on the parking brake handle.

CAUTION

Care should be exercised when setting brakes that are overheated, or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls may be secured with the front seat belts. Wheels should be blocked if chocks are available.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Chock the wheels.
(5) Secure tie-down ropes to the wing tie-down rings and the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots, or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install pitot head cover(s) if available. Be sure to remove the pitot head cover(s) before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

(e) Jacking

The airplane is equipped with a jacking pad on each main spar just outboard of the engine nacelle. When the airplane is raised on jacks, the tail skid serves as a support position. To jack the airplane, proceed as follows:

(1) Place the jacks under the jack pads.
(2) Attach the tail support to the tail skid. Place approximately 250 pounds of ballast on the support to hold the tail down.

CAUTION

Be sure to apply sufficient tail support ballast; otherwise the airplane may tip forward and damage the nose section.

(3) Raise the jacks until all three wheels clear the floor.

8.11 SERVICING AIR FILTERS

Induction air filters should be cleaned and examined at least once every fifty hours. Filters should be replaced if the paper filter material is torn or ruptured, if the housing is damaged, or if the filter is excessively dirty. The usable life of an air filter should be restricted to one year or 500 hours, whichever comes first. Depending on the conditions in which the airplane is operated, filters may have to be cleaned or replaced at shorter intervals.

(a) Normally Aspirated Airplanes

(1) Remove the cover plate from the air cleaner box by turning the quick disconnect wing nut fasteners. Remove the filter from the box.
(2) Check the filter. If it is damaged or excessively dirty, replace it immediately.
(3) Clean the filter by tapping it against a hard surface to remove grit, sand and dirt, being careful not to damage the filter. Do not attempt to blow out dirt with compressed air.
(4) If the filter is found to be in good condition after cleaning, reinstall the filter.
(5) Before reinstalling the filter, examine the filter gasket. It should have no tears and should be securely in place.

(b) Turbocharged Airplanes

(1) Remove the two machine screws from the securing brackets on both sides of the filter box and remove the filter.
(2) Check the filter. If it is damaged or excessively dirty, replace it immediately.
(3) Clean the filter by one of the two following methods:
   a. Keeping the air nozzle at least one inch from the filter, direct a jet of air not exceeding 100 psi up and down the pleats on the clean air side of the filter. This method will remove grit, dust, and sand from the filter.
   b. If carbon, soot, or oil remain on the filter after completing the above procedure, soak the filter for 15 minutes in a good non-sudsing detergent; then swish it gently in the solution for about two minutes. Rinse the filter with a stream of water not exceeding 40 psi until the rinse water is clear. Dry the filter thoroughly before reinstalling, but do not use light bulbs or extreme heat for drying.
(4) Recheck the filter for damage, and if it is found to be clean and sound, reinstall the filter.
(5) Before reinstalling the filter, examine the filter gasket. It should have no tears and should be securely in place.

8.13 BRAKE SERVICE

The brake system incorporates a hydraulic fluid reservoir through which the brake system is serviced periodically. Fluid is drawn from the reservoir by the brake master cylinders to maintain the volume of fluid required for maximum braking efficiency. Spongy brake pedal action is often an indication that the brake fluid reservoir is running low on fluid.

The brake fluid reservoir should be filled to the level marked on the reservoir with MIL-H-5606 fluid. The reservoir, located in the left side of nose section, should be checked at every 100 hour inspection and the fluid replenished as necessary.

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8.15 HYDRAULIC SYSTEM SERVICE

The hydraulic system for the landing gear and flaps is filled through a filler tube located inside the left nose access panel. Only petroleum base MIL-H-5606 hydraulic fluid should be used. To add fluid to the system, remove the cap from the filler neck and fill the system completely while holding the filler tube extension in a level position. Then turn the elbow on the filler tube down until the excess fluid has drained out.

8.17 LANDING GEAR SERVICE

The operation of the landing gear shock struts is standard for the air-oil type; hydraulic fluid passing through an orifice serves as the major shock absorber, while air compressed statically acts as a taxiing shock absorber. To provide proper oleo action, the main and nose gear struts must have approximately 3 inches of piston tube exposed under static loads. All major attachments and actuating bearings are equipped with grease fittings for the lubrication of bearing surfaces and require periodic lubrication.

Air and oil are added to a strut through the valve at the top of the unit. To add air to a strut, a strut pump should be attached to the air valve and pumped until three inches of strut piston is exposed with normal static weight on the gears. (Normal static weight is the empty weight of the airplane plus full fuel and oil.)

To add fluid to a strut, the airplane must be placed on jacks and a pan should be placed under the gear to catch spillage. All air must be released from the strut by depressing the valve core pin. When all air is released and the strut is fully extended, the air valve (filler plug) should be removed with the valve core intact. With the strut extended two inches from full compression, hydraulic fluid should be added through the filler opening. The strut should then be fully compressed, allowing excess fluid to overflow and expelling trapped air. With the strut compressed, the air valve may be reinstalled and the strut inflated with air.

8.19 TIRE SERVICE

Tires should be maintained at the proper pressures. Main wheel tires should be inflated to 46 psi and the nose wheel tire to 27 psi if it is four-ply rated or 32 psi if it is six-ply rated. Periodically, the tires should be visually checked for wear, cracks, cuts, bruises, or breaks.

To produce even wear, tires may be reversed on the wheels. All tires and wheels are balanced before installation, and the relationship of tire, tube and wheel should be maintained upon reinstallation. Out-of-balance wheels can cause extreme vibration of the landing gear during takeoffs and landings.

8.21 PROPELLER SERVICE

The propeller blades, spinners, and visible hub parts should be checked frequently for damage. If cracks, nicks, scratches, or corrosion is present, repairs should be made as soon as possible by a rated mechanic. A nick or a scratch may cause an area of increased stress which could lead to more serious propeller damage.

The coat of flat black paint on the back surface of the propeller blades helps to retard glare. To prevent corrosion, the surfaces of the propellers and spinners should be cleaned and waxed periodically.

8.23 OIL REQUIREMENTS

The oil capacity of a Lycoming IO-540 or TIO-540 series engine is 12 U.S. quarts. It is recommended that the engine oil and oil filter element be changed every 50 hours of operation, and more frequently under unfavorable operating conditions. The following oil grades are recommended for the specified temperature:

LUBRICATING OIL RECOMMENDATIONS
USE AVIATION ENGINE OIL FOR PISTON ENGINES

Outside Air Temperature	MIL-L-6082B Straight Mineral SAE Grades	(Reference Aviation Grades)	MIL-L-22851 Ashless Dispersant SAE Grades
Above 60°F	50	100	20W-40 or 50
30° to 90°F	40	80	20W-40
0° to 70°F	30	65	20W-40 or 20W-30
Below 10°F	20	–	20W-30

(Refer to the Lycoming S.I. 1014 latest revision when changing from straight mineral to ashless dispersant oil)

8.25 FUEL SYSTEM

(a) Fuel Requirements

The minimum octane aviation grade fuel to be used in the Aztec F is 91/96 in normally aspirated airplanes and 100/130 in turbocharged airplanes. The use of lower grades of fuel can cause serious engine damage in a short period of time and is considered of such importance that the engine warranty is invalidated by such use. Refer to paragraph 1.7, Fuel.

(b) Servicing Fuel System

At every 50 hour inspection, screens and bowls in the fuel filter units should be cleaned.

(c) Filling Fuel Cells

Observe all safety precautions required when handling gasoline. Fuel is put into the tank through the fillers on the top surface of the wings. The inboard fillers are for the thirty-six gallon inboard cells, and the outboard fillers are for the thirty-six gallon outboard cells and also for the optional twenty gallon tip tanks when they are installed. When using less than the standard 144 gallon capacity or the 184 gallon capacity with optional tip tanks, fuel should be distributed equally between each side. The placards at the fuel fillers specify the minimum octane fuel which may be used in the airplane.

(d) Draining Fuel Valves and Lines

During the preflight check, fuel valves and lines should be drained to insure that moisture and sediment are removed from the low points in the system. Fuel strainer and fuel line drains are located inside the access doors on the undersides of the nacelles, inboard of the main wheel wells. The three drains inside each access door - inboard and outboard tank and fuel strainer drains - are opened by pushing up on the easy drain valves. It is recommended that fuel be drained into a clear container so that the fuel can be examined for moisture and contaminants.

The fuel crossfeed system should be drained periodically. This is accomplished by opening the crossfeed line drain control located on the front of the fuel management panel between the front seats. With the crossfeed on, the left electric fuel pump and then the right electric fuel pump should be turned on and then off.

When the draining operations are completed, fuel drains should be checked from outside the airplane to ensure that they are completely closed.

CAUTION

When draining fuel, care should be taken to ensure that no fire hazard exists before starting the engines.

(e) Draining Fuel System

The bulk of the fuel may be drained from the system by pumping the fuel out of each tank through the filler opening with a remote fuel pump. Draining may be completed by opening the crossfeed line drain control. Inboard cells should be drained first; then fuel selectors should be moved to the outboard position, allowing the outboard cells to drain through the crossfeed line drain. For an alternate draining procedure, the fuel line quick drain valves and the fuel strainer drains may be opened, or the fuel strainer bowl may be removed, allowing the fuel to run out by gravity.

8.27 BATTERY SERVICE

The battery may be reached through the detachable access panel on the right side of the nose section. The battery is enclosed in a sealed stainless steel box, the lid of which is attached with wing nuts. The battery box has a plastic drain tube which is normally closed off with a clamp and which should be opened occasionally to drain off any accumulation of fluid. The battery should be checked for the proper fluid level. The battery must not be filled above the baffle plates and it must not be filled with acid - use water only.

Battery connections should be clean and tight. Seepage may be cleaned from the battery and box by flushing with a solution of soda and water with the drain open, then rinsing with clear water. The soda solution must not be allowed to enter the battery. The battery and box should then be dried and the drain clamp reinstalled.

A hydrometer check will determine the percent of charge present in the battery. The battery should be removed from the airplane for charging. To prevent accidental short circuiting or arcing when the battery is removed or installed, the ground cable should be removed first and installed last. Quick charges are not recommended. The 24 volt battery should be charged starting with a rate of 2 amperes and finishing with 1 ampere.

8.29 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until the solvent has evaporated or otherwise been removed.

(4) Remove the protective covers from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-23-250 Service Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a cover of plastic or a similar waterproof material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear with solvent or a mixture of solvent and degreaser. To remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow it to dry.
(4) Remove the protective cover and the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the PA-23-250 Service Manual.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water solution. Harsh abrasives or alkaline soaps or detergents could scratch painted or plastic surfaces or corrode metal. Cover areas where a cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge, or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease stains, use a soft cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to protect and preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coat of wax on leading surfaces will reduce the abrasion problems in these areas. Refer to item (h) when surface deicers are installed.

(d) Cleaning Windshield and Windows

CAUTION

Use only mild soap and water when cleaning the heated windshield. Use of ANY other cleaning agent or material may cause distortion or damage to windshield coatings.

(1) Remove dirt, mud, and other loose particles from exterior surfaces with clean water.
(2) Wash interior and exteriosr window surfaces with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.

(3) Remove oil and grease with a cloth dampened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, other strong solvents, or window cleaning sprays. Do not use plastic cleaner on heated glass windshields.

(4) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge.
(5) When windows are clean, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion, Do not apply wax on the optional heated windshield.

(e) Cleaning Headliner, Side Panels, and Seats

(1) Remove loose particles with a stiff bristle brush and a vacuum cleaner. Frequent vacuuming will prevent loose dirt from being worked into the fabric.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. The manufacturer's instructions should be followed carefully. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water solution. Avoid saturation and never use harsh cleaning solutions or detergents on leather.
(4) Plastic trim, the control wheels, and control knobs can be cleaned with a cloth dampened with soap and water.

(f) Cleaning Carpets

Loose dirt can be removed from carpets with a whisk broom or a vacuum cleaner. A nonflammable dry cleaning fluid may be used on soiled spots and stubborn stains. Floor carpets may be removed and cleaned like any household carpet.

(h) Cleaning Surface Deicing Equipment*

When the deicers are clean, a coating of B.F. Goodrich Icex should be applied. Icex is compounded to lower the strength of adhesion between ice and the rubber surface of the deicer boots.

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on the boots, direct a blast of warm air along the region being cleaned, using a portable type ground heater.

As an alternate cleaning solvent, use benzol or nonleaded gasoline. Moisten the cleaning cloth in the solvent, scrub lightly, and then, with a clean, dry cloth, wipe dry so that the cleaner does not have time to soak into the rubber. Petroleum products such as these are injurious to rubber, and therefore should be used sparingly if at all.

*Optional equipment

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SECTION 9

SUPPLEMENTS

4 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

This section provides Instructions for Continued Airworthiness for the GTX 33X and GTX 3X5 with ADS-B installation. This section satisfies the requirements for continued airworthiness as defined by 14 CFR Part 23.1529 and Part 23 appendix G. Information in this section is required to maintain the continued airworthiness of the GTX 33X and GTX 3X5 as installed under this AML STC.

4.1 Applicability

This document applies to all aircraft equipped with GTX 33X and GTX 3X5 units with ADS-B per STC SA01714WI.

Modification of an aircraft by this STC obligates the aircraft operator to include the maintenance information provided by this document in the operator's Aircraft Maintenance Manual and the operator's Aircraft Scheduled Maintenance Program.

4.2 Airworthiness Limitations

There are no airworthiness limitations associated with this type design change (STC SA01714WI).

The Airworthiness Limitations section is FAA approved and specifies maintenance required under §43.16 and §91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

18-OCT-2016

FAA APPROVED **Michael Warren** **Date**
ODA STC Unit Administrator
ODA-240087-CE

4.3 Servicing Information

GTX 33X and GTX 3X5 LRU maintenance is "on condition" only. Component-level overhaul is not required for the GTX 33X and GTX 3X5 with ADS-B installation.

4.3.1 On Condition Servicing

On Condition replacement and/or servicing should occur when an item exhibits conditions, symptoms, and/or abnormalities as defined in section 5 of this manual. Replacement and/or servicing should be made only after the technician troubleshoots the system by using the guidance in this manual along with common avionics maintenance practices.

4.3.2 Special Tools

The following tools are needed to perform maintenance tasks.

- Calibrated milliohm meter with an accuracy of ±0.1 milliohm or better
- Calibrated transponder ramp tester
- Calibrated Pitot/static ramp tester
- GTX 3X5 Install Tool (remote units only)
- 50 Ω 5 watt antenna load

4.4 Maintenance Intervals

Table 4-1 shows systems and components, installed by this STC, which must undergo tests or checks at specific intervals. The inspections based on calendar elapsed time have specifically stated intervals.

NOTE

The maintenance intervals listed in the table below must be adhered to for each installed GTX.

Table 4-1 Maintenance Intervals

Item	Description/Procedure	Section No.	Interval
Equipment Removal and Reinstallation	Removal and reinstallation of GTX LRUs.	6	On Condition
Cleaning	The GTX 330 and GTX 335/345 display and bezel may be cleaned periodically. Cleaning is accomplished using a soft cotton cloth dampened with clean water. **DO NOT** use any chemical cleaning agents. Avoid scratching the surface of the display.	N/A	On Condition
Antenna Visual Inspection	Removal and replacement.	4.5	On Condition
Lightning Strike - Actual or Suspected	Inspect the coaxial cable connections, GTX bonding hardware (including bonding straps and tape), antenna, and surrounding areas.	4.5	On Condition
	The GTX 33/330 and GTX 3X5 receiver sensitivity must be tested and shown to comply with Title 14 CFR Part 43 Appendix F.	8.4.2	On Condition
Testing	The GTX 33/330 and GTX 3X5 must be tested and shown to comply with Title 14 CFR Part 91.227.	8.4.3	Replacement of GPS Position source(s).
Equipment Visual Inspection	A visual inspection of the equipment installed by this STC must be performed.	4.5	12 Calendar Months
Testing	The GTX 33/330 and GTX 3X5 must be tested and shown to comply with Title 14 CFR Part 91.411, 91.413, and Part 43 Appendix E and F.	8.4.2	Refer to Title 14 CFR Part 91.411, 91.413, and Part 43 Appendix E and F.
Electrical Bonding Test	An electrical bonding test must be performed on equipment installed by this STC.	4.6	10 Years or 2000 hours

4.5 Visual Inspection

Perform a visual inspection in accordance with requirements in this section. Check for corrosion, damage, or other defects for each of the installed items. Replace any damaged parts as required. Inspection may require the temporary removal of a unit or units to gain access to connectors. Follow guidance in section 6 for equipment removal and replacement. Refer to appendix A of this manual for equipment locations. Refer to the specific Aircraft Maintenance Manual for instructions on removing any access panels.

GTX 330/330D/335/345 Visual Inspection

During normal aircraft inspections not to exceed 12 calendar month intervals, conduct a visual inspection of the GTX 330/330D/335/345 installation in the following locations.

Instrument Panel

1. Inspect all GTX 330/330D/335/345 keys for legibility of labels and markings.
2. Inspect GTX 330/330D/335/345 units for security of attachment.
3. Inspect mounting rack and hardware for integrity.
    a. Verify the racks, fasteners, and support structure are in good condition and securely fastened.
    b. Inspect for signs of corrosion.
    c. For composite aircraft, inspect any aluminum foil tape used to ground the GTX and verify that it is not torn, damaged, or showing signs of corrosion. If any of these occur then the tape must be replaced. Refer to appendix B for details.
4. Inspect any bonding straps for corrosion, loose connections, or signs of damage. Refer to appendix B for details.
5. Inspect the condition of the wiring harnesses and coaxial cables.
    a. Inspect all instrument panel wiring and coax for chafing, damage, proper routing of wire bundles and security of attachment in accordance with AC 43.13-1B, chapter 11, section 8, paragraph 11-96. Pay particular attention to possible areas of chafing.
    b. Verify that the harness shows no signs of cracking, chafing, abrasion, melting, or any other form of damage.
    c. Inspect the GTX 330/330D/335/345 connectors for corrosion or other defects. Check the integrity of the shield block ground attachments to the harness connector assembly as well as the integrity of the individual shields and their attachment.

GTX 33/33D/335R/345R Visual Inspection

During normal aircraft inspections not to exceed 12 calendar month intervals, conduct a visual inspection of the GTX 33/33D/335R/345R installation in the following locations.

Remote Mount Rack

1. Inspect GTX 33/33D/335R/345R units for security of attachment.
2. Inspect mounting rack and hardware for integrity.
   a. Verify the racks, fasteners, and support structure are in good condition and are securely fastened.
   b. Inspect for signs of corrosion.
   c. For composite aircraft, inspect any aluminum foil tape used to ground the GTX and verify that it is not torn, damaged, or showing signs of corrosion. If any of these occur then the tape must be replaced. Refer to appendix B for details.
3. Inspect any bonding straps for corrosion, loose connections, or signs of damage. Refer to appendix B for details.
4. Inspect the condition of the wiring harnesses and coaxial cables.
   a. Verify that all wiring and cables are securely fastened.
   b. Verify that the harness shows no signs of cracking, chaffing, abrasion, melting, or any other form of damage.
   c. Inspect the GTX 33/33D/335R/345R connectors for corrosion or other defects. Check the integrity of the shield block ground attachments to the harness connector assembly as well as the integrity of the individual shields and their attachment.

Antenna Visual Inspection

During normal aircraft inspections not to exceed 12 calendar month intervals, conduct a visual inspection of the transponder antennas for the following.

1. Leading edge erosion, cracks, dents, or broken antenna. If these conditions are present, antenna must be replaced. Refer to antenna manufacturer's replacement instructions for details.
2. If the attachment is not secure, re-work the installation and complete electrical bonding test specified in section 4.6.
3. Condition of base seals. In the event the antenna seal shows sign of damage or decomposition, re-seal and complete the electrical bonding test specified in section 4.6.

Post Lightning Strike Inspection

A post lightning strike inspection must be performed for a suspected or actual lightning strike to antennas or any temperature sensor connected to the GTX unit. Inspect antenna or sensor and surrounding installation to verify that structural damage has not occurred around the areas where lightning may have attached. If there is visible sign of damage to the antenna or sensor, then it should be replaced.

Inspect the antenna coax connection to GTX unit, grounding hardware, bonding straps or tape, and surrounding areas of the remotely mounted GTX to verify damage has not occurred. Repair any damaged areas and components, then complete the electrical bonding test specified in section 4.6.

4.6 Electrical Bonding Test

1. Disconnect the antenna coaxial cable from the GTX 33X or GTX 3X5.
2. Disconnect all connectors from the GTX 33X or GTX 3X5.
3. Measure the DC resistance between each of the following test points and the aircraft ground reference as defined in table B-1 and verify the resistance is less than or equal to the appropriate periodic test resistance value.
   - Top metal case of GTX 330/335/345 #1 (if installed)
   - Top metal case of GTX 330/335/345 #2 (if installed)
   - GTX 33/335R/345R #1 chassis (if installed)
   - GTX 33/335R/345R #2 chassis (if installed)
4. If the resistance is more than the periodic test resistance value in table B-1, the bond must be improved enough to meet the reconditioned resistance value.

4.7 Additional Instructions

Electrical load information for the GTX is provided in section 2.6.

GTN 625/635/650/725/750 and GMA 35
Instructions for Continued Airworthiness
as installed in

Piper PA-23-250
(Make and Model Airplane)

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Garmin Ltd. Or its subsidiaries
c/o Garmin International, Inc.
1200 E. 151st Street
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Record of Revision

Rev.	Date	Description of Change
1	03/04/2011	Initial Release

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose

This document is designed for use by the installing agency of the Garmin GTN 6XX/7XX Navigators and GMA 35 audio panel as Instructions for Continued Airworthiness in response to 14 CFR § 23.1529, and Part 23 Appendix G. This ICA includes information required by the operator to adequately maintain the Garmin GTN 6XX and 7XX Navigator and GMA 35 system installed under Approved Model List (AML) STC.

1.2 Scope

This document identifies the Instructions for Continued Airworthiness for the modification of the aircraft for installation of the Garmin GTN 6XX/7XX and GMA 35 installed under Approved Model List (AML) STC.

1.3 Document Control

This document shall be released, archived, and controlled in accordance with the Garmin document control system. When this document is revised, refer to Section 2.15 for information on how to gain FAA acceptance or approval and how to notify customers of changes.

1.4 Permission to Use Certain Documents

Permission is granted to any corporation or person applying for approval of a Garmin GTN 6XX/7XX and GMA 35 to use and reference appropriate STC documents to accomplish the Instructions for Continued Airworthiness and show compliance with STC engineering data. This permission does not construe suitability of the documents. It is the responsibility of the applicant to determine the suitability of the documents for the ICA.

1.5 Definitions

The following terminology is used within this document:

1) **ACO:** Aircraft Certification Office
2) **AEG:** Aircraft Evaluation Group
3) **BIT:** Built-In Test
4) **COM:** Communications
5) **CFR:** Code of Federal Regulations
6) **FAA:** Federal Aviation Administration
7) **GPS:** Global Positioning System
8) **ICA:** Instructions for Continued Airworthiness
9) **IFR:** Instrument Flight Rules
10) **LED:** Light Emitting Diode
11) **LRU:** Line Replaceable Unit
12) **NAV:** Navigation
13) **MFD:** Multi-Function Display
14) **PMI:** Principal Maintenance Inspector
15) **POI:** Principal Operations Inspector
16) **STC:** Supplemental Type Certificate
17) **TSO:** Technical Standard Order
18) **TVS:** Transient Voltage Suppressor
19) **WAAS:** Wide Area Augmentation System

1.6 Terminology

Except where specifically noted, references made to the 'GTN' will equally apply to the GTN 625/635/650/725/750. Also, 'GTN 7XX' refers specifically to the GTN 725 and GTN 750, and 'GTN 6XX' refers specifically to the GTN 625, GTN 635, and GTN 650.

Throughout this document references will be made to 'metallic' and 'non-metallic' aircraft. For the purposes of this document, metal aircraft will be those with an aluminum skin. Non-metal aircraft will refer to all other aircraft. (e.g., aircraft with composite skin, or aircraft with tube and fabric construction.)

2. INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

2.1 Introduction

Content, Scope, Purpose and Arrangement:	This document identifies the Instructions for Continued Airworthiness for the modification of the aircraft by installation of the Garmin GTN 6XX/7XX Navigators.
Applicability:	Applies to aircraft altered by installation of the Garmin GTN 6XX/7XX and GMA 35.
Definition of Abbreviations:	See Sections 1.5 and Section 1.6
Precautions:	None
Units of measurement:	None
Referenced publications *: * or later FAA Approved revisions	Garmin 190-01007-A3 Rev. 2, *"GTN 6XX/7XX AML STC Installation Manual"* Garmin 190-01007-03 Rev. A, *"GTN 725/750 Pilot's Guide"* Garmin 190-01004-03 Rev. A, *"GTN 625/635/650 Pilot's Guide"*
Retention:	This document, or the information contained within, will be included in the aircraft's permanent records.

The GTN 6XX/7XX AML STC Installation Manual (190-01007-A3) is referenced extensively throughout this document. To improve readability, references to the installation manual are abbreviated as GTN-IM.

2.2 Description of Alteration

The GTN navigators are a family of aviation panel mounted retro-fit products. GTN units utilize a touchscreen as the primary control interface. Traditional knobs and buttons have been minimized to simplify access to the color multi-function display (MFD), NAV and COM transceiver, and GPS/WAAS navigator functions.

The GTN 625/635/650 Navigators (Garmin Touch Navigation) are a new family of 2.65-inch tall aviation panel mounted retro-fit products that are intended to supersede the Garmin 400W Series Navigators. The GTN 6XX product family consists of the GTN 625 GPS/WAAS navigator, the GTN 635 GPS/WAAS/COM navigator, and the GTN 650 GPS/WAAS/NAV/COM navigator.

The GTN 725/750 Navigators (Garmin Touch Navigation) are a new family of 6.00-inch tall aviation panel mounted retro-fit products that are intended to supersede the Garmin 500W Series Navigators.

The GTN 7XX product family consists of the GTN 725 GPS/WAAS navigator, and the GTN 750 GPS/WAAS/NAV/COM navigator.

The optional GMA 35 is an audio panel with a Marker Beacon receiver. The GMA 35 in conjunction with a GTN 7XX provide full audio panel capability, for communication and navigation radios, headsets, microphones, and speakers. The GMA 35 is mounted in a notch behind the GTN 7XX to free up mounting space in the flight deck instrument panel. Installation of the GTN, specific for the aircraft installation, is documented in GTN-IM.

2.3 Control, Operating, and Testing Information

See the *GTN 6XX Pilot's guide* and the *GTN 7XX and GMA 35 Pilot's Guide* for system operating information. See section 2.1 for document part numbers. See GTN-IM for a system description and system limitations.

See GTN-IM, Section 5 for checkout and self-test information. See GTN-IM, Section 5.10 for general ground checks and system test procedures.

2.4 Servicing Information

None. In the event of system failure, troubleshoot the GTN 6XX/7XX and GMA 35 in accordance with Section 2.6 Troubleshooting Information below.

2.5 Periodic Maintenance

The GTN and GMA 35 are designed to detect internal failures. A thorough self-test is executed automatically upon application of power to the units, and built-in tests (BIT) are continuously executed. Detected errors are indicated as failure annunciations, system messages, or a combination of the two.

Operation of the GTN 6XX/7XX and GMA 35 is not permitted unless the inspections described in this section have been completed within time intervals prescribed in Table 1 below. All antennas connected to the GTN should be maintained in accordance with appropriate inspection data for the antenna installation.

Table 1 - Maintenance Intervals

Item	Description/Procedure	Interval
Equipment Removal & Replacement	Removal and replacement of GTN or GMA units Removal and replacement instructions are contained in Section 2.7 of this document and in GTN-IM, Section 3.4.1.	**On Condition**
Cleaning the Front Panel	The front bezel, keypad, and display can be cleaned with a soft cotton cloth dampened with clean water. DO NOT use any chemical-cleaning agents. Care should be taken to avoid scratching the surface of the display.	**On Condition**
Display Backlight	The display backlight LEDs are rated by the manufacturer as having a usable life of at least 36,000 hours. This life may be more or less than the rated time depending on the operating conditions of the GTN. Over time, the backlight lamp may dim and the display may not perform as well in direct sunlight conditions. The user must determine by observation when the display brightness is not suitable for its intended use. Contact the Garmin factory repair station when the backlight lamp requires service.	**On Condition**

Item	Description/Procedure	Interval
Battery Replacement	The GTN has an internal keep-alive battery that will last about 10 years. The battery is used for GPS system information. Regular planned replacement is not necessary. The GTN will display a 'low battery' message when replacement is required. Once the low battery message is displayed, the battery should be replaced within 1 to 2 months. If the battery is not replaced and becomes totally discharged, the GTN unit will remain fully operational, but the GPS signal acquisition time may be increased. There is no loss of function or accuracy of the GTN unit with a dead battery. The battery must be replaced by the Garmin factory repair station or factory authorized repair station.	**On Condition**
Equipment Visual Check	Conduct a visual check of the GTN unit and its wire harness to ensure continued installation integrity. 1. Inspect the GTN unit(s) for security of attachment, including visual inspection of mounting racks and other supporting structure attaching the racks to aircraft instrument panel. Verify the countersunk fastener heads are in full contact with unit mounting rack holes. Re-torque to 8.5-9.5 in-lbs if required. 2. Inspect for signs of corrosion. 3. Inspect all knobs and buttons for legibility. 4. Inspect condition of wiring, shield terminations, routing, and attachment/clamping. 5. Check the fan intake slots on the sides and bottom of the GTN unit's bezel for dust, dirt, or obstructions. Clean as needed. 6. Conduct a visual check of the GPS/WAAS antenna cable overbraid in accordance with Section 8.2.1.3 of the GTN-IM. 7. Conduct a visual check of the WXR cable overbraid in accordance with Section 8.2.1.4 of the GTN-IM If installed.	**12 Calendar Months**
Test-TVS Lightning Protection	The GTN #1 main power input will have a TVS located at the LRU, for IFR non-metallic aircraft only. The TVS must be checked or replaced in accordance with section 8.2.1 of the GTN-IM.	**24 Calendar Months**
Test-Lightning Protection	The GTN #1 main power input and NAV power input will have a TVS located at the LRU, for IFR non-metallic aircraft only. The TVS must be replaced in accordance with section 8.2.1 of the GTN-IM. Conduct a visual check of the GPS/WAAS antenna cable overbraid in accordance with Section 8.2.1.3 of the GTN-IM. Conduct a visual check of the WXR cable overbraid in accordance with Section 8.2.1.4 of the GTN-IM if installed.	**After a suspected or actual lightning strike**

Item	Description/Procedure	Interval
Test-Bonding Check (IFR-certified aircraft only)	Perform an electrical bonding check: 1. Perform electrical bond check between the GTN and nearby exposed portion of the aircraft metallic structure and verify that it is less than 10 milliohms. 2. Remove GTN unit from mounting rack. 3. Measure the resistance between the mounting rack and nearby exposed portion of aircraft metallic structure and verify it is less than 10 milliohms. 4. Reinstall the GTN unit in the mounting rack. In the event of bonding test failure, remove the GTN rack and clean the attachment points at both the GTN rack and the aircraft structure per section 2.5.4 of the GTN-IM and reattach the rack to the rails in the panel. Re-verify the resistance between the mounting rack and nearby exposed portion of aircraft metallic structure and ensure it is less than 2.5 milliohms.	**Every 2000 flight hours or ten (10) years, whichever is first**

2.6 Troubleshooting Information

If error indications are displayed on the GTN 6XX or 7XX, consult the GTN-IM, Section 6, Troubleshooting. Refer to the GTN System Configuration and Checkout Log retained in the aircraft permanent records for a list of the interfaced equipment and system configuration data (example log provided in GTN-IM).

2.7 Removal and Replacement Information

For GTN removal and replacement instructions, refer to GTN-IM Section 3.4.1.1 and Section 3.4.1.2. For GMA 35 removal and replacement instructions, refer to GTN-IM Section 3.4.1.3 and Section 3.4.1.4.

If any GTN LRUs are removed and reinstalled, verify that the LRU unit power-up self-test sequence is successfully completed and no failure messages are annunciated.

If any work has been done on the aircraft that could affect the system wiring, or any interconnected equipment, verify the GTN system unit power-up self-test sequence is successfully completed and no failure messages are annunciated.

Refer to Appendix A of this document or the GTN 6XX/7XX System Configuration and Checkout Log retained in the aircraft permanent records for GTN equipment location.

Refer to the GTN-IM for particular LRU removal/installation procedures and special handling precautions.

2.8 Diagrams

Aircraft specific LRU locations and wire routing diagram are contained in Appendix A of this document.

GTN-IM Appendix B provides diagrams showing sample installation for LRU locations. Appendix E provides point-to-point wiring diagrams for the GTN and interfaced equipment. Appendix F provides point-to-point wiring diagrams for the GMA 35 and interfaced equipment.

Refer to the GTN System Configuration and Checkout Log retained in the aircraft permanent records for a list of the interfaced equipment and unit configuration data (example log provided in GTN-IM).

2.9 Special Inspection Requirements

2.9.1 Lightning Protection Checks

In the event of a suspected or actual lightning strike to the aircraft, the checks outlined in Table 1 for Test-Lightning Protection must be completed.

2.10 Application of Protective Treatments

None. N/A.

2.11 Data Relative to Structural Fasteners

None. N/A.

2.12 Special Tools

For electrical bonding testing, a milli-ohm meter is required.

2.13 Additional Instructions

Refer to GTN-IM Section 3.7 for Electrical Load information applicable to the GTN and GMA 35.

2.14 Overhaul Period

The system does not require overhaul at a specific time period. Power on self-test and continuous BIT will monitor the health of the GTN system. If any LRU indicates an internal failure, the unit may be removed and replaced. See GTN-IM, Section 6 for Troubleshooting information.

2.15 ICA Revision and Distribution

To revise this ICA, Garmin will follow the Garmin ODA procedures manual SOP-055/ACP-016 for Instructions for Continued Airworthiness. The latest revision of this ICA document is available on the Garmin website (www.garmin.com). A Garmin Service Bulletin describing ICA revision will be sent to Garmin dealers if a revision is determined to be significant.

2.16 Assistance

Flight Standards Inspectors or the certificate holder's PMI have the required resources to respond to questions regarding this ICA. In addition, the customer may refer questions regarding this equipment and its installation to the manufacturer, Garmin. Garmin customer assistance may be contacted during normal business hours via telephone 913-397-8200 or email from the Garmin web site at www.garmin.com.

2.17 Implementation and Record Keeping

Modification of an aircraft by this Supplemental Type Certificate obligates the aircraft operator to include the maintenance information provided by this document in the operator's aircraft maintenance manual and/or the operator's aircraft scheduled maintenance program.

3. AIRWORTHINESS LIMITATIONS SECTION

There are no additional Airworthiness Limitations as defined in 14 CFR § 23, Appendix G. G23.4 that result from this modification.

The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

APPENDIX A - EQUIPMENT LOCATION AND WIRE ROUTING

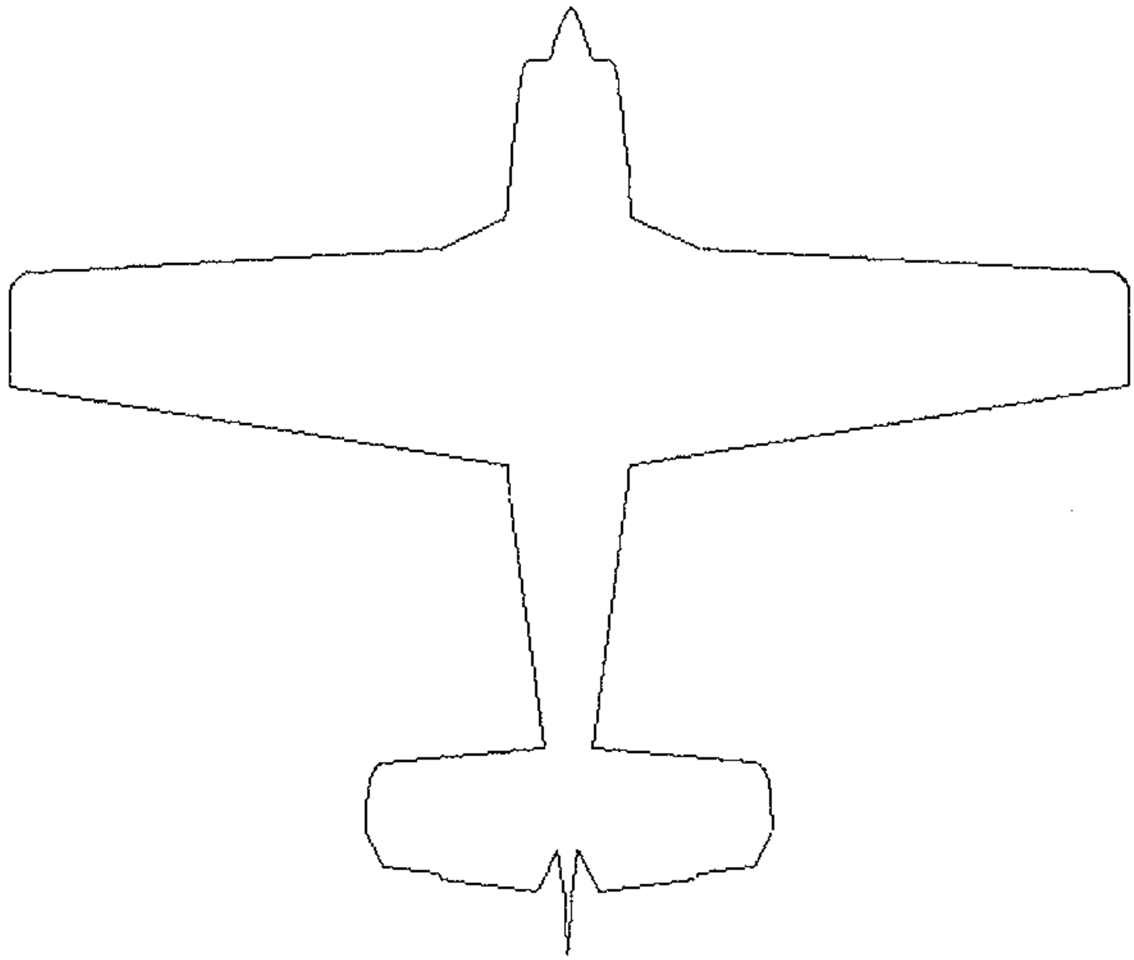
A.1 LRU LOCATIONS

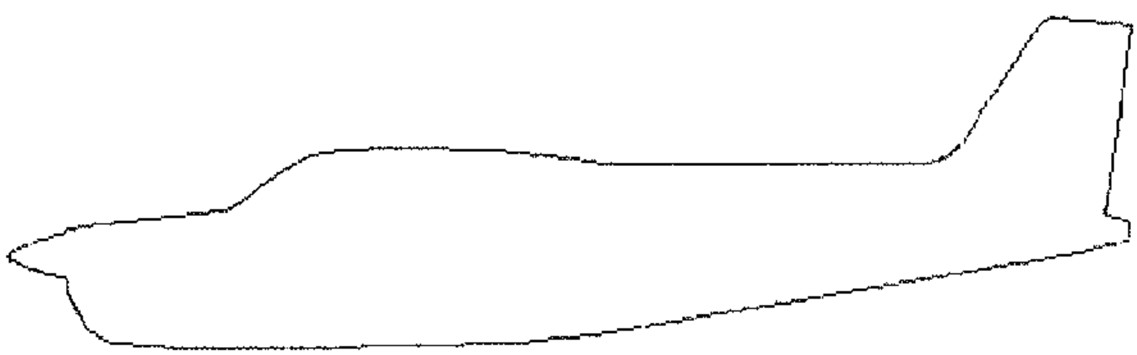
The table below describes the locations of the GTN 6XX/7XX and GMA 35. Check all that apply.

LRU	LRU included in this installation?	Description of Location
GTN 625 #1	☐ Yes ☐ No	
GTN 625 #2	☐ Yes ☐ No	
GTN 635 #1	☐ Yes ☐ No	
GTN 635 #2	☐ Yes ☐ No	
GTN 650 #1	☐ Yes ☐ No	
GTN 650 #2	☐ Yes ☐ No	
GTN 725 #1	☐ Yes ☐ No	
GTN 725 #2	☐ Yes ☐ No	
GTN 750 #1	☐ Yes ☐ No	
GTN 750 #2	☐ Yes ☐ No	
GMA 35	☐ Yes ☐ No	

A.2 Wire Routing – Single-Engine

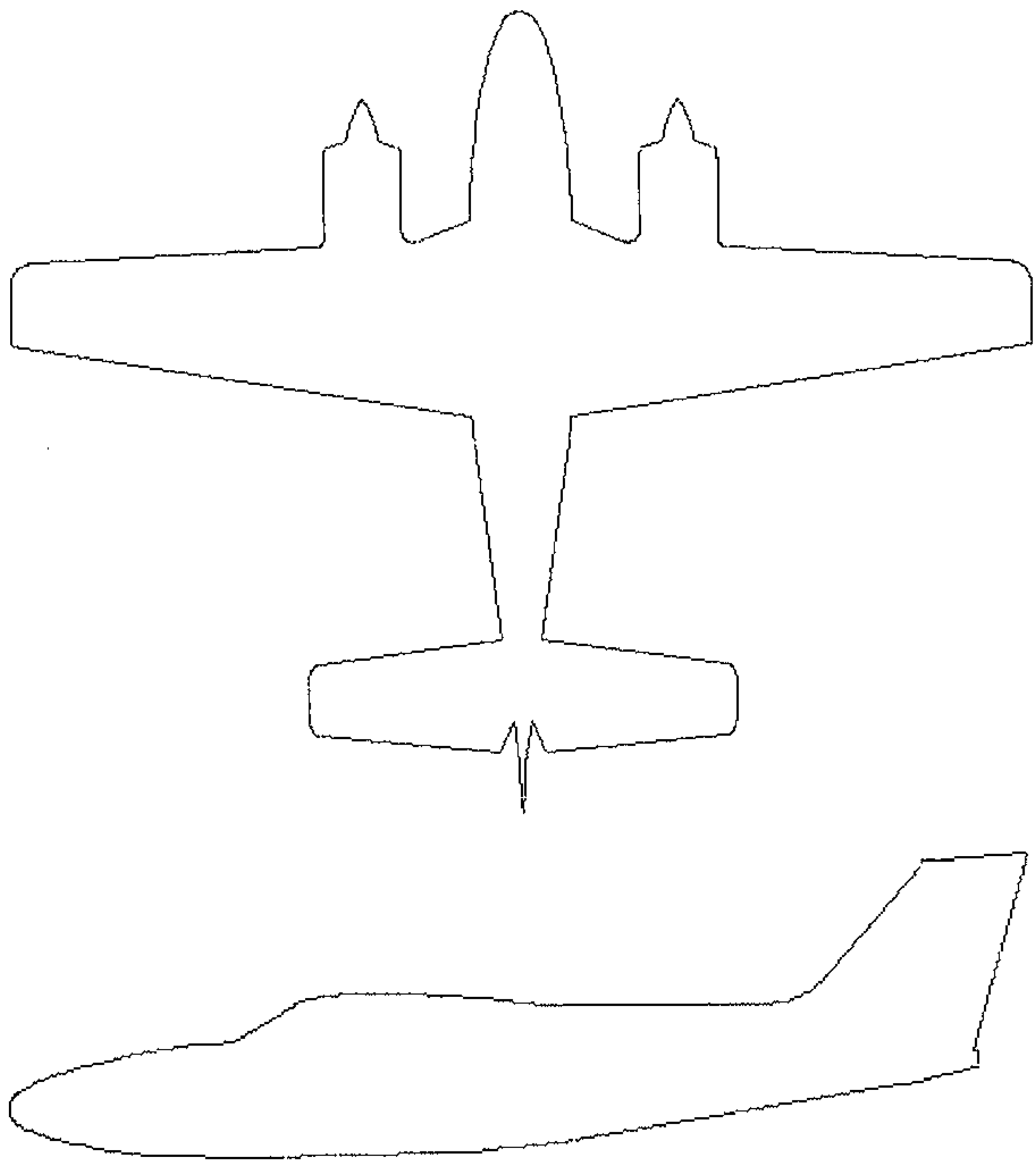
The following diagram depicts approximate location of all LRUs and antenna(s) along with the wire routing for the GTN 6XX/7XX and GMA 35 throughout the aircraft structure for a single-engine aircraft:





A.3 Wire Routing – Twin-Engine

The following diagram depicts approximate location of all LRUs and antenna(s) along with the wire routing for the GTN 6XX/7XX and GMA 35 throughout the aircraft structure for a twin-engine aircraft:



SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of supplements which are necessary for efficient operation of the airplane when it is equipped with one or more of the various optional systems and equipment not approved with the standard airplane.

All of the supplements provided in this section are "FAA Approved" and consecutively numbered as a permanent part of this handbook. The information contained in each supplement applies only when the related equipment is installed in the airplane.

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SUPPLEMENT 1

OXYGEN SYSTEM INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional oxygen system is installed. The information in this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in the handbook at all times when the optional oxygen system is installed.

SECTION 2 - LIMITATIONS

(a) No smoking while the oxygen system is in use.

(b) Placards
At each oxygen outlet:

"NO SMOKING WITH OXYGEN IN USE"

At the oxygen control knob:

"PULL ON, PUSH OFF, OXYGEN"

On rear baggage door:

CAUTION

BE CERTAIN BAGGAGE DOORS
ARE PROPERLY CLOSED AND
LOCKED PRIOR TO FLIGHT

MAX. FLOOR LOAD
100 LBS. PER SQ. FOOT
TOTAL COMPARTMENT CAPACITY
105 LBS.
INCLUDES 20 LBS. ON SHELF

BAGGAGE/CARGO MUST BE LOADED
WITHIN THE WEIGHT AND BALANCE LIMITS
OF THIS AIRCRAFT

SECTION 3 - EMERGENCY PROCEDURES

In the event that during operation the red indicator appears in any of the flow indicators, check for oxygen quantity and assure proper engagement of the oxygen mask in the receptacle. If oxygen cannot be supplied, the aircraft should be lowered to a safe altitude immediately.

SECTION 4 - NORMAL PROCEDURES

(a) Check the pressure gauge in the rear of the cabin for sufficient oxygen pressure for anticipated requirements for flight. Full system pressure is approximately 1850 PSIG. If necessary, recharge the cylinder.

(b) When oxygen is desired, pull out the oxygen control knob, actuating a cable which places the regulator in the "ON" position.

(c) At seating positions where oxygen is to be used, plug the mask assembly into the oxygen outlet, turn the fitting clockwise 90°, and check that fitting is secured by the detent in the oxygen outlet. Secure mask to face.

(d) The flow indicator located in the mask assembly oxygen line should be checked. When the red indicator disappears, oxygen is flowing through the line normally.

(e) To stop the flow of oxygen to all outlets, push in the oxygen control knob, placing the regulator in the "OFF" position. To stop flow to individual air mask, remove the mask fitting from the oxygen outlet by turning the fitting 90° counterclockwise and pulling it out of the outlet.

(f) If the oxygen tank has a pressure of 1850 psi when the use of oxygen is begun, oxygen will be available as shown below:

Crew	Passengers	Oxygen Supply Range in Hours
1		25.76
1	1	14.72
1	2	10.30
1	3	7.93
1	4	6.44
1	5	5.42

With 2 Pilot's Masks		Oxygen Supply Range in Hours
2		12.88
2	1	9.37
2	2	7.36
2	3	6.07
2	4	5.15

SECTION 5 - PERFORMANCE

Installation of the oxygen system does not affect the basic performance information presented in Section 5 of this Pilot's Operating Handbook.

SUPPLEMENT 2

LYCOMING TURBOCHARGED ENGINES INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the PA-23-250 (Six Place) airplane when the optional Lycoming TIO-540-C1A turbocharged engines are installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

NOTE

For Limitations, Procedures, and Performance information not contained in this supplement, consult the applicable sections of the basic portion of this Handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in the handbook at all times when the optional Lycoming turbocharged engines are installed.

SECTION 2 - LIMITATIONS

(a)	Engine	Lycoming Model No. TIO-540-C1A
	Horsepower	250
	Rotation Speed (RPM)	2575
	Max. Manifold Press. at or below 18,500 ft. mean sea level (in. Hg.)	39.5
	Max. Manifold Press. at 24,000 mean sea level (in. Hg.)	31.0

(Straight line variation between points given)

NOTE

This airplane and equipment has been substantiated to 24,000 ft.

(b)	Fuel Grade (minimum octane)	100/130 - Green
(c)	Propellers	Hartzell HC-E2YR-2 Series Constant Speed, Full Feathering
	Blade Model	8465-7R
	Pitch Settings at 30 in. Station	
	Feather	80°
	Low	15.2°

(d) Cowl Flaps

Cowl flaps are provided to allow manual control of engine temperatures. The cowl flaps should be open during ground operations and in climbs. In no case should the cylinder head temperature be allowed to exceed 500°F or the oil temperatures allowed to exceed 245°F. The cowl flaps must be fully open during climbs above 18,000 ft. when an alternator is loaded to 60 amps or more.

(e) Instrument Markings (Power Plant)

Oil Temperature	
Green Arc (Normal Operating Range)	120° to 245°F
Yellow Arc (Caution)	60° to 120°F
Red Line (Maximum)	245°F
Oil Pressure	
Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution)	25 PSI to 60 PSI and 90 PSI to 100 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI
Tachometer	
Green Arc (Normal Operating Range)	500 RPM to 2575 RPM
Red Line (Maximum)	2575 RPM
Manifold Pressure	
Red Line (Never Exceed)	39.5 IN. HG.
Fuel Flow	
Green Arc (Normal Operating Range)	0 GPH to 32.0 GPH
Red Line (Maximum at Sea Level)	32.0 GPH (14.0 PSI)
Exhaust Gas Temperature	
Green Arc (Normal Operating Range)	Zero or lower scale limit to 1650°F
Red Line (Never Exceed)	1650°F
Cylinder Head Temperature	
Green Arc (Normal Operating Range)	200°F to 500°F
Red Line (Maximum)	500°F

(f) Airspeed Limitations and Indicator Markings - Normal Category

	CAS Knots	IAS Knots
Never Exceed Speed (Above 21,000 ft. reduce V_{NE} 4.3 Kts. per 1,000 ft.)	216	221
Maximum Structural Cruising Speed	172	175
Design Maneuvering Speed	129	131
Flaps Extended Speeds	60 to 108	55 to 108
Full Flap	108	108
Half Flap	122	123
Quarter Flap	139	141
Maximum Gear Extended Speed	130	132
Minimum Control Speed (Single Engine)	70	64
Stall Speed		
Gear and Flaps Up	67	61
Gear and Flaps Down	60	55
Best Single Engine Angle of Climb Speed	87	83
Best Single Engine Rate of Climb Speed	90	87
Airspeed Indicator Markings (KIAS)		
Green Arc (Normal Operating Range)		61 to 175
Yellow Arc (Caution Range - Smooth Air)		175 to 221
White Arc (Flaps Extended Range)		55 to 108
Radial Red Line (Never Exceed - Smooth Air)		221
Radial Red Line (Minimum Control Speed - Single Engine)		64
Radial Blue Line (Best Single Engine Rate of Climb Speed)		87

(g) Flight Load Factors

Positive Load Factor (Maximum) at 5200 Lbs.	3.68 G
Negative Load Factor (Maximum) at 5200 Lbs.	-1.47 G

(No Inverted Maneuvers Approved)

(h) Maximum Weights

Maximum Gross Weight	5200 LBS
Maximum Takeoff Weight	5200 LBS
Maximum Landing Weight	4940 LBS
Maximum Zero Fuel Weight	4500 LBS

IT IS THE RESPONSIBILITY OF THE AIRPLANE OWNER AND THE PILOT TO ASSURE THAT THE AIRPLANE IS PROPERLY LOADED. SEE "WEIGHT AND BALANCE" SECTION FOR PROPER LOADING INSTRUCTIONS.

(i) C. G. Range

Weight Pounds	Forward Limit Inches Aft of Datum	Aft Limit Inches Aft of Datum
5200	99.0	100.5
5000	95.6	100.5
4630	93.0	100.5
3600	87.6	100.5

(j) The corrected noise level of this aircraft measured with TIO-540-C1A engines is76.2d BA.

No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

The above statement notwithstanding, the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

(k) Placards
On the instrument panel:

"ABOVE 21,000 FEET REDUCE V_{ne} SPEED 4.3 KNOTS PER 1,000 FEET."

SECTION 3 - EMERGENCY PROCEDURES

Installation of the Lycoming turbocharged engines does not affect the basic Emergency Procedures presented in Section 3 of this Pilot's Operating Handbook.

SECTION 4 - NORMAL OPERATING PROCEDURES

The following instructions apply specifically to PA-23-250 (Six Place) airplanes with Lycoming TIO-540-C1A turbocharged engines installed. Refer to Normal Procedures presented in Section 4 of this Pilot's Operating Handbook for all other normal operating procedures.

(a) Under full throttle operations (such as takeoff and climb) the engines of this aircraft have been adjusted to provide 33.0 in. Hg. of manifold pressure at sea level and standard temperature. It is possible to have a reading higher (up to 39.5 inches of manifold pressure) or lower than 33.0 inches of manifold pressure when corresponding ambient temperatures are higher or lower than standard.

(b) The engines of this airplane are equipped with dynamic counterweight systems. Therefore, avoid rapid closing or opening of the throttle in order to prevent serious damage which could cause malfunction.

(c) When increasing power, increase engine speed prior to increasing manifold pressure. When decreasing power, decrease manifold pressure before decreasing engine speed.

(d) See Lycoming instructions for the approved leaning procedure.

SECTION 5 - PERFORMANCE

Section 5 of this Pilot's Operating Handbook presents information which shows the effect of the optional Lycoming turbocharged engines installation on the Performance of the airplane.

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SUPPLEMENT 3

ALTIMATIC V-1 INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional AltiMatic V-1 is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on Bendix STC No. SA429SO and must remain in this handbook at all times when the optional AltiMatic V-1 is installed.

NOTE

The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight tests was 24,000 feet.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Do not engage autopilot if airplane is out of trim.
(c) Maximum airspeed for autopilot operation is 213 kts. IAS.
(d) During autopilot operation, the pilot must be in his seat with the safety belt fastened.
(e) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(f) During autopilot operation, the wing flaps must be fully retracted.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
- (1) In the event a malfunction in the autopilot performance is detected, the pilot must immediately disengage the autopilot by momentarily pressing the autopilot release switch on the control wheel.
- (2) Maximum altitude loss during malfunction tests in the following flight configurations:
  - a. Cruise, Climb, Descent 160 feet
  - b. ILS Approach 100 feet

(b) PITCH TRIM
- (1) If trim warning light illuminates in flight, turn trim quick disconnect switch OFF and pull the pitch trim circuit breaker; have system inspection prior to operation.
- (2) If electric trim runs at any time without actuating the trim switch, turn the trim quick disconnect switch to OFF.
- (3) If the trim circuit breaker releases or the trim follow-up becomes inoperative during autopilot operation, disengage the autopilot and pull the trim circuit breaker.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breakers for both systems.

SECTION 4 - NORMAL PROCEDURES

(a) AUTOPILOT MASTER SWITCH - Turn the Autopilot Master Switch to ON.
(b) BEFORE TAKEOFF - Engage the autopilot, apply a force to the controls (on one axis at a time) to determine if the autopilot may be overpowered.
  (1) Press HDG, NAV, APPR, REV buttons one at a time, place pitch command disc in center detent position and check respective lights on the Flight Controller for operation.
  (2) Disengage the autopilot and recheck aircraft pitch trim before takeoff.
(c) PITCH TRIM INDICATOR - Centering the Pitch Trim Indicator (by rotating the pitch command) prior to engagement will insure that the aircraft will continue in its present attitude. However, if the Trim Indicator is not centered, aircraft will smoothly take up the attitude dictated by the pitch command.
(d) GYRO CHECK - Check Attitude Gyro for proper erection. Set the Directional Gyro, if manual slaving type.
(e) RELEASE SWITCH - Disengage the autopilot by momentarily depressing the trim switch (on the left side of the pilot's control wheel) up or down, and recheck aircraft pitch trim before takeoff.
(f) ENGAGE BUTTON - This button is located on the left side of the Autopilot Controller. Manually adjust aircraft trim prior to engaging autopilot. Place aircraft in WINGS-LEVEL attitude. Press the ENGAGE BUTTON which will light upon engagement.
  (1) To climb, rotate the Pitch Command Disc to UP. To descend, rotate the Pitch Command Disc to DN. The change in pitch ANGLE is determined by the amount of rotation of the pitch command disc.
  (2) To make turns, use heading mode. See Step (j).
(g) AUTOMATIC PITCH TRIM is provided whenever the autopilot is engaged. Any attempt to overpower the autopilot pitch axis will cause the pitch trim to oppose the applied force, resulting in an out-of-trim condition and high stick forces.

  To manually operate the elevator trim tab, the autopilot must be disengaged. Pushing the RELEASE switch will disengage the autopilot.
(h) MANUAL ELECTRIC TRIM is provided as standard equipment with the PIPER ALTIMATIC V-1 installation. The following operating instructions apply:

  General

  The manual electric trim system is powered through the aircraft master switch, which must be on for electric trim operation. A circuit breaker located on the circuit breaker panel provides circuit protection. Also, a trim quick disconnect switch is located on the pilot's control wheel. This switch is of the push-on, push-off type. If the electric trim fails to operate, push the trim quick disconnect switch to determine that it is in the on position.

  The manual electric trim is obtained by actuating the electric trim switch on the pilot's control wheel in the desired direction. During normal autopilot operations, actuation of the trim switch in either direction disconnects autopilot and electric trim is immediately available. A system fault or malfunction will be indicated by the trim warning light, but trim will not run away (see Trim Emergency Procedures).

Preflight

The following preflight shall be conducted prior to each flight and during flight as considered appropriate.

(1) Autopilot master switch - ON
(2) Trim warning light - OUT
(3) Manual trim crank freedom of movement - Check
(4) Actuate electric trim slide switch and observe proper direction of movement of manual trim crank - Check.
(5) Press the press-to-test button next to the trim warning light. Light should light while being pressed and trim should not run - Check.
(6) Push trim quick disconnect switch to OFF. Push trim switch to UP or DN. Trim should not run.

(i) AUTOMATIC ALTITUDE CONTROLLER

(1) Altitude control is automatically engaged when the pitch command disc is in the center detent position unless the altitude control disable switch on the front of the flight controller is pulled.
(2) Rotating the pitch command disc from detent position disengages altitude control and glide slope.
(3) When pitch command disc is in center detent position, ALT light on flight controller will light.

NOTE

The altitude controller attempts to maintain the aircraft at the selected altitude by changing the pitch attitude of the aircraft. The human pilot must then maintain power settings to assure a safe airspeed.

NOTE

If for any reason there is a deviation from the selected altitude of more than approximately 300 feet, the altitude controller will recycle to the new altitude.

(j) HEADING SELECTOR - The heading knob on the Directional Gyro may be used to select any heading prior to pushing the (HDG) heading engage button. When the heading engage button is pressed, the aircraft will turn to the selected heading in the direction which is less than 180°, and at a bank angle of no more than 25°, and HDG light on the heading button will light.

(k) OMNI BEARING SELECTOR

NOTE

There are two methods of intercepting a VOR.

(1) Variable intercept angle - With this method, the pilot may preselect any intercept angle desired.
    a. After identifying desired omni station, select desired omni course on the NAV indicator by rotating the OBS knob.

b. Position the heading bug to select the desired intercept angle by rotating the HDG knob on the heading indicator. The number of degrees between the OBS and the heading bug is the intercept angle. The pilot should not select an intercept angle less than 20° or more than 90°.

c. Simultaneously press HDG and NAV buttons on the controller. HDG and NAV buttons will light. The aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume an automatic 45° intercept angle.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the HDG bug must be reset to the same heading as the selected omni course when the HDG light goes out.

(2) Fixed intercept angle

a. After identifying the desired omni station, select desired omni course on the NAV indicator by rotating the OBS knob.

b. Press the NAV button. Button light comes on. Aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the selected omni bearing. If the omni bearing selected is less than 120° from the aircraft heading when the NAV mode is selected, the aircraft will turn toward the selected omni course. At angles of 120° or greater, the aircraft will turn away from the selected omni and continue to turn through the larger angle until a proper intercept angle is established. In either case, the aircraft will assume an intercept course which will be no greater than 45° to the selected omni course.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the HDG bug must be reset to the same heading as the selected omni course.

(l) AUTOMATIC APPROACH COUPLER

NOTE

Coupled approaches must be conducted with wing flaps fully retracted.

NOTE

There are two methods of intercepting the localizer.

(1) Variable intercept angle - This method is recommended when being vectored toward the localizer, by approach control, with the HDG and APPR modes engaged.

a. Set course to the published inbound course by rotating the OBS knob on the NAV indicator.

b. Position the heading bug and select the desired intercept angle by rotating the HDG knob on the heading indicator.

c. Simultaneously press HDG and APPR buttons on the controller. HDG and APPR buttons will light. Aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button on the controller will go out and the aircraft will assume an automatic 45° intercept angle.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the HDG bug must be reset to the same heading as the selected omni course when the HDG light goes out.

(2) Fixed intercept angle

a. Set course to the published inbound course by rotating the OBS knob on the NAV indicator.

b. Press the APPR button on the controller. APPR button light will come on and aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the localizer inbound heading. Aircraft will automatically assume an intercept course of no more than 45° to the localizer. For the reason explained in Paragraph (k)(2)b., do not select APPR until the aircraft heading is less than 120° from the localizer inbound heading.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the HDG bug must be reset to the same heading as the selected omni course.

(3) When the APPR button is pressed, Glide Slope is automatically armed and the aircraft will bracket the Glide Slope and begin a rate of descent commensurate with the Glide Slope angle and airspeed providing the following conditions are met:

a. Glide Slope Pointer on NAV Indicator is centered.

b. Pitch command disc is in center detent (altitude hold) position.

c. Aircraft is established on localizer beam at least 20 seconds prior to Glide Slope interception.

d. Auto GS disable knob is not pulled.

NOTE

This system is equipped with a manual Glide Slope button and can capture the Glide Slope automatically as outlined in Paragraph (l)(3) or manually by pressing the GS button when the Glide Slope Pointer centers, provided the aircraft is in altitude hold and APPR mode, and GS disable knob is not pulled.

(4) When the aircraft couples to the Glide Slope signal the GS light on the controller will light, and ALT light extinguishes.

(5) Glide Slope may be disengaged and altitude or attitude maintained while flying the localizer by pulling the GS disable knob, or pressing NAV button on the controller or rotating the pitch command disc out of detent until the aircraft has departed the Glide Slope by one dot.

(6) For a Back Course Localizer approach select the localizer front course inbound heading. Press REV button on controller. Both APPR and REV button lights will light indicating to the pilot that he is in both the localizer and reverse modes.

(7) Go-around button in the left throttle lever knob may be pressed anytime the pilot decides not to continue the approach to landing. Pressing the GA button will cause the aircraft to automatically assume a pitch attitude of approximately eight degrees nose up (pilot must adjust power settings to maintain airspeed). Aircraft will continue to hold on to localizer. GA light on controller will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to selected heading, and remain in a pitch up attitude of approximately eight degrees. Movement of the pitch command disc will disengage the GA mode. GA light will go out, aircraft will take up a wings-level attitude depending on the position of pitch command disc.

(8) If the approach is carried to completion, upon reaching ILS minimums the Automatic Pilot Release Switch must be momentarily pressed, thus disconnecting the Automatic Pilot and returning the aircraft to manual control for completion of the landing.

SECTION 5 - PERFORMANCE

Installation of the AltiMatic V-1 does not effect the basic Performance information presented by Section 5 of this handbook.

SUPPLEMENT 4

ALTIMATIC V F/D-1 INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional AltiMatic V F/D-1 is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on Bendix STC No. SA429SO and must remain in this handbook at all times when the optional AltiMatic V F/D-1 is installed.

NOTE

The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight tests was 24,000 feet.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Do not engage autopilot if airplane is out of trim.
(c) Maximum airspeed for autopilot operation is 213 kts. IAS.
(d) During Flight Director/Autopilot operation, the pilot must be in his seat with the safety belt fastened.
(e) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(f) During autopilot operation, the wing flaps must be fully retracted.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
  (1) In the event a malfunction in the autopilot performance is detected, the pilot must immediately disengage the autopilot by momentarily pressing the autopilot release switch on the control wheel.
  (2) Maximum altitude loss during malfunction tests in the following flight configurations:
    a. Cruise, Climb, Descent 160 feet
    b. ILS Approach 100 feet

(b) PITCH TRIM
  (1) If trim warning light illuminates in flight, turn trim quick disconnect switch OFF and pull the pitch trim circuit breaker; have system inspection prior to operation.
  (2) If electric trim runs at any time without actuating the trim switch, turn the trim quick disconnect switch to OFF.

(3) If the trim circuit breaker releases or the trim follow-up becomes inoperative during autopilot operation, disengage the autopilot and pull the trim circuit breaker.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breakers for both systems.

SECTION 4 - NORMAL PROCEDURES

(a) FD/AP MASTER SWITCH - Turn FD/AP Master Switch to ON.
(b) The Flight Director incorporates a Director Horizon in lieu of the conventional Artificial Horizon. In addition to supplying attitude information to the computer, the Director Horizon displays command dots which receive information from the computer in the same manner as the autopilot servos. By maneuvering the aircraft to satisfy the command dots, the pilot is acting in the same manner as the autopilot servos.
(c) Adjust pitch command to align the command dots with the simulated red tip tanks of the Director Horizon.
(d) BEFORE TAKEOFF - Engage the autopilot, apply a force to the controls (on one axis at a time) to determine if the autopilot may be overpowered.
 (1) Press HDG, NAV, APPR, REV buttons one at a time, place pitch command disc in center detent position and check respective lights on the Flight Controller for operation.
 (2) Disengage the autopilot and recheck aircraft pitch trim before takeoff.
(e) PITCH TRIM INDICATOR - Centering the Pitch Trim Indicator (by rotating the pitch command) prior to engagement will insure that the aircraft will continue in its present attitude. However, if the Trim Indicator is not centered, aircraft will smoothly take up the attitude dictated by the pitch command.
(f) RELEASE SWITCH - Disengage the autopilot by momentarily depressing the trim switch (on the left side of the pilot's control wheel) up or down, and recheck aircraft pitch trim before takeoff.
(g) ENGAGE BUTTON - This button is located on the left side of the Autopilot Controller. Manually adjust aircraft trim prior to engaging autopilot. Place aircraft in WINGS-LEVEL attitude. Press the ENGAGE BUTTON which will light upon engagement.
 (1) To climb, rotate the Pitch Command Disc to UP. To descend, rotate the Pitch Command Disc to DN. The change in pitch ANGLE is determined by the amount of rotation of the pitch command disc.
 (2) To make turns, use heading mode. See Step (k).
(h) AUTOMATIC PITCH TRIM is provided whenever the autopilot is engaged. Any attempt to overpower the autopilot pitch axis will cause the pitch trim to oppose the applied force, resulting in an out-of-trim condition and high stick forces.
 To manually operate the elevator trim tab, the autopilot must be disengaged. Pushing the RELEASE switch will disengage the autopilot.
(i) MANUAL ELECTRIC TRIM is provided as standard equipment with the PIPER ALTIMATIC V F/D-1 installation. The following operating instructions apply:

General

The manual electric trim system is powered through the aircraft master switch, which must be on for electric trim operation. A circuit breaker located on the circuit breaker panel provides circuit protection. Also, a trim quick disconnect switch is located on the pilot's control wheel. This switch is of the push-on, push-off type. If the electric trim fails to operate, push the trim quick disconnect switch to determine that it is in the on position.

The manual electric trim is obtained by actuating the electric trim switch on the pilot's control wheel in the desired direction. During normal autopilot operations, actuation of the trim switch in either direction disconnects autopilot and electric trim is immediately available. A system fault or malfunction will be indicated by the trim warning light, but trim will not run away (see Trim Emergency Procedures).

Preflight

The following preflight shall be conducted prior to each flight and during flight as considered appropriate.

(1) FD/AP master switch - ON
(2) Trim warning light - OUT
(3) Manual trim crank freedom of movement - Check
(4) Actuate electric trim slide switch and observe proper direction of movement of manual trim crank - Check.
(5) Press the press-to-test button next to the trim warning light. Light should light while being pressed and trim should not run - Check.

(j) AUTOMATIC ALTITUDE CONTROLLER
(1) Altitude control is automatically engaged when the pitch command disc is in the center detent position unless the altitude control disable switch on the front of the flight controller is pulled.
(2) Rotating the pitch command disc from detent position disengages altitude control and glide slope.
(3) When pitch command disc is in center detent position, ALT light on flight controller will light.

NOTE

The altitude controller attempts to maintain the aircraft at the selected altitude by changing the pitch attitude of the aircraft. The human pilot must then maintain power settings to assure a safe airspeed.

NOTE

If for any reason there is a deviation from the selected altitude of more than approximately 300 feet, the altitude controller will recycle to the new altitude.

(k) HEADING SELECTOR - The heading knob on the Horizontal Situation Display may be used to select any heading prior to pushing the (HDG) heading engage button. When the heading engage button is pressed, the command dots will command the direction and attitude to satisfy the heading command, the aircraft will turn to the selected heading in the direction which is less than 180°, and at a bank angle of no more than 25°, and HDG light on the heading button will light.

(l) OMNI BEARING SELECTOR - There are two methods of intercepting a VOR.
(1) Variable Intercept Angle - With this method, the pilot may preselect any intercept angle desired.
a. After identifying desired OMNI station, select desired OMNI course on the Horizontal Situation Display by rotating the CRS knob on the HSD until the course arrow aligns with the desired OMNI course.

b. Position the Heading Select Pointer (heading bug) in the quadrant toward the Lateral Deviation Needle (left/right needle) and select the desired intercept angle by rotating the HDG knob on the Horizontal Situation Display. The number of degrees between the Course Arrow and the Heading Select Pointer is the intercept angle. The pilot should not select an intercept angle less than 20° or more than 90°.

c. Simultaneously press HDG and NAV buttons on the controller. HDG and NAV buttons will light. Aircraft will turn toward the heading selected until the Lateral Deviation Needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume an automatic 45° intercept angle.

(2) Fixed Intercept Angle

a. After identifying the desired OMNI station, select desired OMNI course on the Horizontal Situation Display by rotating the CRS knob on the HDS until the course arrow aligns with the desired OMNI course.

b. Press the NAV button. Button light comes on. Aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the selected OMNI bearing. If the OMNI bearing selected is less than 120° from the aircraft heading when the NAV mode is selected, the aircraft will turn toward the selected OMNI course. At angles of 120° or greater, the aircraft will turn away from the selected OMNI course and continue to turn through the larger angle until a proper intercept course is established. In either case, the aircraft will assume an intercept course which will be no greater than 45° to the selected OMNI course.

(m) AUTOMATIC APPROACH COUPLER

NOTE

Coupled approaches must be conducted with the wing flaps fully retracted.

(1) As in the case of the NAV mode, there are two methods of intercepting the localizer.

a. Variable Intercept Angle - This method is very handy when being vectored toward the localizer, by approach control, with the Headings and APPR modes engaged.

1. Align Course Arrow to the published inbound course by rotating the CRS knob on the HSD.
2. Position the Heading Select Pointer in the quadrant toward the Lateral Deviation Needle and select the desired intercept angle by rotating the HDG knob on the HSD.
3. Simultaneously press HDG & APPR buttons on the controller. HDG & APPR buttons will light. Aircraft will turn toward the heading selected until the Lateral Deviation Needle moves approximately one dot away from full deflection. At this time, the HDG button light on controller will go out and the aircraft will assume an automatic 45° intercept angle.

b. Fixed Intercept Angle

1. Align the Course Arrow to the published inbound course by rotating the CRS knob on the HSD.
2. Press the APPR button on the controller. APPR button light will come on and the aircraft will turn left or right depending upon the relation of the aircraft heading to that of the localizer inbound heading. Aircraft will automatically assume an intercept course no more than 45° to the localizer. For the reason explained in Paragraph (l) (2) b., do not select APPR until the aircraft heading is less than 120° from the localizer inbound heading.

(2) When the APPR button is pressed, Glide Slope is automatically armed and the aircraft will bracket the Glide Slope and begin a rate of descent commensurate with the Glide Slope angle and airspeed providing the following conditions are met:
  a. Glide Slope Pointer on HSD is centered.
  b. Pitch command disc is in center detent (altitude hold) position.
  c. Aircraft is established on localizer beam at least 20 seconds prior to Glide Slope interception.
  d. Auto GS disable knob is not pulled.

NOTE

This system is equipped with a manual Glide Slope button and can capture the Glide Slope automatically as outlined in Paragraph (m)(2), or manually by pressing the GS button when the Glide Slope Pointer centers, providing the aircraft is in altitude hold and APPR mode, and GS disable knob is not pulled.

(3) When the aircraft couples to the Glide Slope signal the GS light on the controller will light and ALT light extinguishes.
(4) Glide Slope may be disengaged and altitude or attitude maintained while flying the localizer by pulling the Auto GS Disable knob, or pressing NAV button on the controller or rotating the pitch command disc out of detent until the aircraft has departed the Glide Slope by one dot.
(5) For a Back Course Localizer approach select the localizer front course inbound heading. Press REV button on controller. Both APPR and REV button lights will light indicating to the pilot that he is in both the localizer and reverse modes.
(6) Go-around button in the left throttle lever knob may be pressed anytime the pilot decides not to continue the approach to landing. Pressing the GA button will cause the aircraft to automatically assume a pitch attitude of approsimately eight degrees nose up (pilot must adjust power settings to maintain airspeed). Aircraft will continue to hold on to localizer. GA light on controller will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to selected heading, and remain in a pitch up attitude of approximately 8 degrees. Movement of the pitch command disc will disengage the GA mode. GA light will go out, aircraft will take up a wings-level attitude depending on position of pitch command disc.
(7) If the approach is carried to completion, the Automatic Pilot Release Switch must be momentarily pressed prior to landing, thus disconnecting the Automatic Pilot and returning the aircraft to manual control for completion of the landing.

SECTION 5 - PERFORMANCE

Installation of the AltiMatic V F/D-1 does not effect the basic Performance information presented by Section 5 of this handbook.

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SUPPLEMENT 5

ALTIMATIC IIIC INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional AltiMatic IIIC is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional AltiMatic IIIC is installed.

SECTION 2 - LIMITATIONS

(a) The maximum speed for autopilot operation is 190 kts. IAS. (Autopilot Vmo)
(b) Reduce autopilot Vmo 4.3 kts. IAS for each 1000' above 21,000'.
(c) Use of flaps not authorized during autopilot operation.
(d) Autopilot "OFF" during takeoff and landing.
(e) Placard PN 13A660 "Conduct Trim check prior to flight (see A F/M)" to be installed in clear view of pilot.

SECTION 3 - EMERGENCY PROCEDURES

AUTOPILOT EMERGENCY PROCEDURE

This aircraft is equipped with a Master Disconnect/Interrupt Switch on the pilot's control wheel. When the switch button is depressed it will disconnect the autopilot. When depressed and held it will interrupt all Electric Elevator Trim Operations. Trim operations will be restored when the switch is released. If an autopilot or trim emergency is encountered, do not attempt to determine which system is at fault. Immediately depress and hold the Master Disconnect/Interrupt button. Turn off autopilot and trim master switch and retrim aircraft, then release the interrupt switch.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breakers for both systems.

(a) In the event of an autopilot malfunction the autopilot can be:
 (1) Overpowered at either control wheel.

CAUTION

Do not overpower autopilot pitch axis for periods longer than 3 seconds because the autotrim system will operate in a direction to oppose the pilot and will, thereby, cause an increase in the pitch overpower forces.

(2) Disconnected by depressing the Master Disconnect/Interrupt Switch.
(3) Disconnected by depressing the Trim Switch "AP OFF" bar.
(4) Disconnected by pushing the roll rocker switch "OFF."

(b) In the event of a trim malfunction:
(1) Depress and hold the Master Trim Interrupt Switch.
(2) Trim Master Switch - "OFF." Retrim aircraft as necessary using manual trim system.
(3) Release Master Interrupt Switch - be alert for possible trim action.
(4) Trim Circuit Breaker - Pull. Do not operate trim until problem is corrected.
(5) If the Trim system operates only in one direction, pull the C.B. and do not operate the trim system until corrective action is taken. Monitor autopilot operation closely when operating without trim follow-up.

(c) If a trim runaway occurs with the autopilot operating, the above procedures will disconnect the autopilot which will immediately result in higher control wheel forces. Be prepared to manually retrim, as necessary to eliminate undesirable forces.

(d) Single Engine Operations
(1) Engine failure during an autopilot approach operation: Disengage autopilot conduct remainder of approach manually.
(2) Engine failure during go around: Disengage autopilot, retrim aircraft, perform normal aircraft engine out procedures then re-engage autopilot.
(3) Engine failure during normal climb, cruise, descent: Retrim aircraft, perform normal aircraft engine out procedures.
(4) Maintain aircraft yaw trim throughout all single engine operations.

(e) Altitude Loss During Malfunction:
(1) An autopilot malfunction during climb or cruise with a 3 second delay in recovery initiation could result in as much as 60° of bank and 420 foot altitude loss.
(2) Altitude loss - high altitude descent -3 second delay in recovery could result in a 35° bank and a 600 foot altitude loss.
(3) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 20° of bank and 100' altitude loss. Maximum altitude loss measured in approach configuration gear down and operation either coupled or uncoupled, single or multi-engine.

EMERGENCY OPERATION WITH OPTIONAL HSI
(Slaved and/or Non-Slaved)

(a) Appearance of HDG Flag:
(1) Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg min.).
(2) Check compass circuit breaker.
(3) Observe display for proper operation.
(b) To disable heading card - pull circuit breaker and use magnetic compass for directional data. Note: If heading card is not operational, autopilot should not be used.

(c) With card disabled:
  (1) NSD 360 - VOR and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture. The Localizer left-right information is still usable, Flag information is disabled - compare needle with # 2 indicator for valid left-right needle operation.
  (2) NSD 360A - VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(d) Salving Failure - (i.e. failure to self correct for gyro drift):
  (1) Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
  (2) Check for HDG Flag.
  (3) Check compass circuit breaker.
  (4) Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

  (5) Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7 below.
  (6) Reset heading card while checking slaving meter. If proper slaving indication is not obtained.
  (7) Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION - AUTOPILOT

(a) Roll Section
  (1) Place Radio Coupler in "Heading" mode and place roll rocker switch "ON" to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
  (2) Set proper D.G. Heading on D.G. and turn Heading Bug to aircraft heading. Engage "Heading" mode rocker switch and rotate heading bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.
  (3) Disengage autopilot by depressing trim switch. Check aileron operation is free and autopilot is disconnected from controls.

(b) Pitch Section
  (1) Engage "Roll" rocker switch.
  (2) Center pitch command disc and engage "Pitch" rocker switch.
  (3) Rotate pitch command disc up and then down and check control yoke moves same direction. Check to see that servo can be overridden by hand at control wheel.

NOTE

Autopilot might not be able to raise elevators, on ground, without assistance from pilot.

(4) Hold control yoke and disengage autopilot by pressing Master Autopilot Disconnect//Trim Interrupt Switch button. Check Roll and Pitch controls to assure autopilot has disconnected.

General

This aircraft is equipped with a Command Trim System designed to withstand any type of single malfunction, either mechanical or electrical, without uncontrolled operation resulting. The preflight check procedure is designed to uncover hidden failures that might otherwise go undetected. Proper operation of the electric elevator trim system is predicated on conducting the following preflight check before each flight. If the trim system fails any portion of the procedure. pull the trim circuit breaker out until trim system is repaired. Substitution of any trim system component for another model is not authorized. For emergency interrupt information, refer to Section 3 of this Supplement.

Command Electric Trim Switch

The Command Electric Trim Switch on the left hand portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the Autopilot.
(2) When the top bar is pressed AND the rocker is moved forward, nose down trim will occur, when moved aft, nose up trim will occur.

(c) Pre-Flight: Command Trim - Before Each Flight
(1) Check trim circuit breaker - IN.
(2) Trim Master Switch - ON.
(3) AP OFF - Check normal trim operation - UP. Grasp trim wheel and check override capability. Check nose down operation. Recheck override.
(4) With trim operating - depress interrupt switch - trim should stop - release interrupt switch - trim should operate.
(5) Activate center bar only - Push rocker fore and aft - only. Trim should not operate with either separate action.

(d) Autotrim - Before Each Flight
(1) AP ON - (Roll and Pitch Sections) Check automatic operation by activating autopilot command UP then DN. Observe trim operation follows pitch command direction.

NOTE

In autopilot mode, there will be approximately a 3 second delay between operation of pitch command and operation of trim.

(2) Press center bar (AP OFF) - release - check autopilot disengagement.
(3) Rotate trim crank to check manual trim operation. Reset to takeoff position prior to takeoff.

AUTOPILOT IN-FLIGHT PROCEDURE

(a) Trim airplane (Ball Centered).

(b) Check air pressure or vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section
  (1) To engage. Center ROLL knob, push ROLL rocker to "ON" position. To turn, rotate console ROLL knob in desired direction. (Maximum angle of bank should not exceed 30°.)
  (2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate to select desired heading. Push console heading rocker (HDG) to "ON" position. (Maximum angle to bank will be 20° with heading lock engaged.)

(d) Pitch Section (Roll section must be engaged prior to pitch section engagement).
  (1) Center pitch trim indicator with the pitch command disc.
  (2) Engage pitch rocker switch. To change attitude, rotate pitch command disc in the desired direction.

(e) Altitude Hold
Upon reaching desired or cruising altitude, engage altitude hold mode rocker switch. As long as Altitude Hold mode rocker is engaged, aircraft will maintain selected altitude. For maximum passenger comfort, rate of climb or descent should be reduced to approximately 500 FPM prior to altitude hold engagement.

NOTE

Prior to disengaging Altitude Hold mode, rotate Pitch Command to center.

(f) Radio Coupling VOR-ILS with H.S.I. type instrument display. (Optional)
  (1) VOR Navigation
    a. Tune and identify VOR Station. Select desired course by rotating CRS knob of H.S.I.
    b. Select OMNI mode on Radio Coupler.
    c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off-course magnitude, 100% needle deflection will result in 45° intercept angle, diminishing as the needle off-set diminishes.
    d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy, VOR signals. NAV mode should be selected after the aircraft is established on course.

  (2) ILS-LOC Front Course
    a. Set inbound, front, localizer course on H.S.I.
    b. Select LOC-Normal on Radio Coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track the localizer course outbound to procedure turn area.
    c. Engage HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course
   a. Set inbound, front, localizer course on H.S.I.
   b. Select LOC-REV, on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept and track outbound on the back course to the procedure turn area.
   c. Engage HDG mode on autopilot console to engage coupler.

(g) Radio Coupling - VOR/ILS with standard directional gyro. (Optional)

Radio Coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (H.S.I.) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR/ILS course as selected on the O.B.S.

(1) For VOR Intercepts and Tracking:

Select the desired VOR Course and set the HDG bug to the same heading. Select OMNI mode on the coupler and engage HDG mode on the autopilot console.

(2) For ILS Front Course Intercepts and Tracking:

Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and engage HDG mode on the autopilot console.

(3) For LOC Back Course Intercepts and Tracking:

Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode on the coupler and engage HDG mode on the autopilot console.

(h) Coupled Approach Operations

(1) VOR or LOC
   a. After arrival at the VOR Station, track outbound to the procedure turn area as described in Section 4 (f) or (g) as appropriate, and slow to 104-122 kts. IAS
   b. Use HDG mode and Pitch or Altitude Hold modes as appropriate during procedure turn.
   c. At the F.A.F. inbound, return to pitch mode for control of descent and lower landing gear.
   d. At the M.D.A. Select Altitude Hold mode and add power for level flight. Monitor altimeter to assure accurate altitude control is being provided by the autopilot.
   e. Go Around. For missed approach select desired pitch attitude with pitch command disc and disengage altitude hold mode. This will initiate the pitch up attitude change. Immediately add takeoff power and monitor Altimeter and rate of climb for positive climb indication. After climb is established, retract flaps and gear. Adjust attitude as necessary for desired airspeed and select HDG mode for turn from the VOR final approach course.

(2) ILS - Front Course Approach With Glide Slope Capture. (Optional)
   a. Track inbound to L.O.M as described in Section 4 (f) or (g) above and in Altitude Hold mode.
   b. Inbound to L.O.M slow to 104-122 kts. IAS

c. Automatic Glide Slope capture will occur at Glide Slope intercept if the following conditions are met:
   1. Coupler in LOC-Normal mode.
   2. Altitude Hold mode engaged (Altitude Rocker on Console).
   3. Under Glide Slope for more than 20 seconds.
   4. Localizer radio frequency selected on NAV Receiver.

d. At Glide Slope Intercept immediately lower landing gear and reduce power to maintain 104 kts. IAS on final approach, Glide Slope capture is indicated by lighting of the green Glide Slope engage Annunciator Lamp and by a slight pitch down of the aircraft.

e. Monitor localizer and Glide Slope raw data throughout approach. Adjust power as necessary to maintain correct final approach airspeed. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged.

f. Conduct missed approach maneuver as described in (h) (1) e. above.

NOTE

Glide Slope Coupler will not automatically decouple from Glide Slope. Decoupling may be accomplished by any of the following means:

1. Disengage Altitude Mode.
2. Switch Radio Coupler to HDG Mode.
3. Disengage Autopilot.

SECTION 5 - PERFORMANCE

Installation of the AltiMatic IIIC does not effect the basic Performance information presented by Section 5 of this handbook.

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SUPPLEMENT 6

ICING EQUIPMENT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional Icing Equipment is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Icing Equipment is installed.

SECTION 2 - LIMITATIONS

The following items of equipment must be installed and operable to effectively cope with normally encountered icing conditions:

(a) B. F. Goodrich Wing and Tail Pneumatic Deicing Boots Installed per Piper Drawing No. 15585-2.

(b) B. F. Goodrich Electric Propeller Deicing Installed per B. F. Goodrich S.T.C. No. SA195EA, dated June 24, 1964, or FAA approved equivalent or Piper Drawing No. 32740-2. (Ref. Item 504 (c), Aircraft Specification No. 1A10.)

(c) Piper Antennas Installed per P.A.C. Dwg. 31628. No special operating instructions required.

(d) Piper Heated Glass Panel on Windshield Installed per P.A.C. Dwg. 31640-3. (Ref. Item 502 (c), Aircraft Specification No. 1A10.)

(e) Heated Pitot Head per P.A.C. Dwg. 19024-3. No special operating instructions required. (Ref. Item 601 (a), Aircraft Specification No. 1A10.

PLACARDS
(a) At switch:

W'SHIELD
HEAT

(b) At circuit breaker:

W'SHIELD
HEAT

(c) When any of the above icing equipment is not installed, the following placard must be on the instrument panel:

"Warning - This aircraft is not fully equipped for flight in icing conditions."

NOTE

WHEN ALL ITEMS OF EQUIPMENT LISTED ABOVE ARE INSTALLED, PLACARD NO. (c) IS NOT REQUIRED.

SECTION 3 - EMERGENCY PROCEDURES

In the event any of the required icing equipment malfunctions, immediate action must be taken to avoid icing conditions.

SECTION 4 - NORMAL PROCEDURES

(a) Heated Windshield

(1) Prior to flight in conditions where the possibility of encountering icing exists, the HEATED PANEL assembly should be attached to the aircraft and the lead wire plug firmly inserted in socket provided.

(2) An operational check should then be accomplished by turning the HEATED PANEL switch ON for a period not exceeding 30 SEC.

(3) Proper operation is indicated by the glass section being warm to the touch.

(4) If icing conditions are encountered the HEATED PANEL switch should be turned ON and remain ON until the icing conditions cease.

(5) When icing is not prevalent the unit should be turned OFF. UNDER NO CIRCUMSTANCE SHOULD THE UNIT BE TURNED ON FOR A PERIOD EXCEEDING 30 SEC. UNLESS:

a. The aircraft is in flight, or

b. Ice exists on the HEATED PANEL.

CAUTION

This equipment cannot be expected to cope with heavy or very prolonged moderate icing conditions. The latter can be expected to tax the equipment beyond its capacity.

Pilots should always strive to avoid heavy icing conditions. If heavy icing is encountered unexpectedly or unavoidably, prompt action must be taken to get into more favorable flying weather conditions.

NOTE

When all items of equipment listed above are installed, the placard "Warning - This aircraft is not fully equipped for flight in icing conditions." IS NOT REQUIRED. When the heated panel is removed or any of the above listed installed equipment is inoperable (known before flight) the warning placard must be reinstalled.

(b) Pneumatic Deicing System

(1) Operating Procedures

Preflight Check

a. Check wing deice indicator (press-to-test).
b. Check source indicator for pump malfunction.
c. At approximately 2000 RPM, check the deicer operation. Actuate wing deice switch. In approximately three seconds the indicator light will glow, indicating inflation. Also check the deicer boots visually.

Normal Operation

a. Light Icing - Actuate pneumatic wing deice switch. Boots will complete one inflation cycle. Wing deice indicator will glow during the 7 1/2 second inflation period. Most effective deicing is obtained if a thickness of 1/4 to 1/2" of ice is collected before the deicers are operated.
b. Heavier Icing - The wing deice switch will permit the operator to manually cycle the system at any desired time interval, should icing conditions require.

NOTE

With both engines at 2000 RPM and all other system checks normal, a time between boot actuation and indicator light illumination exceeding 4 seconds indicates a leak in the system.

(2) Altitude Limitations on Deicer Boots

The deicer boots have been tested and approved for all altitudes up to and including 24,000 feet with the following limitations in icing conditions:

No. of Pneumatic Pumps	Engine Speed RPM	Altitude	Max. Altitude for Optimum Boot Effectiveness
2	2200	20,000 ft. and below	20,000 ft.
2	2575	Above 20,000 ft.	24,000 ft.
1	2575	All altitudes	15,000 ft.

SECTION 5 - PERFORMANCE

Installation of Icing Equipment does not affect the basic performance information presented in Section 5 of this Pilot's Operating Handbook.

SUPPLEMENT 7

AUTOCONTROL IIIB INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional AutoControl IIIB is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on Edo-Aire Mitchell STC SA3022SW-D and must remain in this handbook at all times when the optional AutoControl IIIB is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 195 kts. IAS. (Autopilot Vmo)
(b) Reduce autopilot Vmo 4.3 kts. IAS for each 1000' above 21,000'.
(c) Autopilot "OFF" during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In an emergency the AutoControl IIIB can be disconnected by:
  (1) Pushing the roll ON-OFF Rocker Switch - "OFF."
  (2) Pulling the Autopilot Circuit Breaker.
(b) The Autopilot can be overpowered at either control wheel.
(c) An autopilot runaway, with a 3 second delay in the initiation of recovery while operating in climb, cruise or descending flight, could result in a 55° bank and 150' altitude loss.
(d) An autopilot runaway, with a 1 second delay in the initiation of recovery, during an approach operation, coupled or uncoupled, could result in a 15° bank and 30' altitude loss.
(e) In the event of engine failure, disconnect autopilot and retrim aircraft, conduct normal engine-out procedures and re-engage autopilot. Maintain aircraft yaw trim during all single engine operations.

EMERGENCY OPERATION WITH OPTIONAL HSI
(Slaved and/or Non-Slaved)

(a) Appearance of HDG Flag:
  (1) Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg min.).
  (2) Check compass circuit breaker.
  (3) Observe display for proper operation.
(b) To disable heading card - pull circuit breaker and use magnetic compass for directional data. Note: If heading card is not operational, autopilot should not be used.

(c) With card disabled - VOR and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
(d) Localizer - left-right information still usable. Flag information is disabled - compare needle with *2 indicator for valid left-right needle operation.
(e) Slaving Failure - (i.e. failure to self-correct for gyro drift):
   (1) Check gyro slaving switch is set to No. 1 position.
   (2) Check for HDG Flag.
   (3) Check compass circuit breaker.
   (4) Reset heading card while observing slaving meter.
   (5) Select slaving amplifier *2 (gyro slaving switch is set to No. 2 position).
   (6) Reset heading card while checking slaving meter.
   (7) Switch to free gyro and periodically set card as unslaved gyro.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION

(a) Autopilot
   (1) Place Radio Coupler in "HDG" Mode (if installed) and place the AP "ON-OFF" switch to the "ON" position to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
   (2) Set proper D.G. heading on D.G. and turn HDG bug to aircraft heading. Engage "HDG" mode rocker switch and rotate HDG bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.
(b) Radio Coupler - (Optional)
   (1) Tune and identify VOR or VOT station. Position Radio Coupler to OMNI Mode. Engage Autopilot "ON" and HDG switches. Set HDG bug to aircraft heading and rotate O.B.S. to cause OMNI indicator needle to swing left and right slowly. Observe that control wheel rotates in direction of needle movement.
   (2) Disengage AP "ON-OFF" switch. Reset Radio Coupler control to HDG.

AUTOPILOT IN-FLIGHT PROCEDURE

(a) Trim airplane (ball centered).
(b) Check air pressure vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.
(c) Roll Section:
   (1) To engage, center Roll knob, push AP "ON-OFF" switch to "ON" position. To turn, rotate console ROLL knob in desired direction. (Maximum angle of bank should not exceed 30°.)
   (2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate bug to aircraft heading. Push console heading rocker (HDG) switch to "ON" position. To select a new aircraft heading, push D.G. heading knob "IN" and rotate, in desired direction of turn, to the desired heading.
(d) Radio Coupling VOR-ILS with H.S.I. (Horizontal Situation Indicator) Type Instrument Display - (Optional)
   (1) VOR Navigation
      a. Tune and identify VOR Station. Select desired course by rotating CRS knob of H.S.I.
      b. Select OMNI mode on Radio Coupler.

c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off course magnitude, 100% needle deflection will result in 45° intercept with the intercept angle diminishing as the needle off set diminishes.
d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisey VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course
a. Set inbound, front, localizer course on H.S.I.
b. Select LOC-Normal on Radio Coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track outbound to the procedure turn area.
c. Select HDG Mode on autopilot console to engage coupler.

(3) ILS-Back Course
a. Set inbound, front localizer course on H.S.I.
b. Select LOC-REV on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept and track outbound on the back course to the procedure turn area.
c. Select HDG mode on autopilot console to engage coupler.

(e) Radio Coupling - VOR/ILS with Standard directional gyro. (Optional)

Radio Coupler operation in conjunction with a standard directional gyro VOR/LOC display differs from operation with an integrated display (H.S.I.) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR course as selected on the O.B.S.

(1) For VOR Intercepts and Tracking:

Select the desired VOR course and set the HDG bug to the same heading. Select OMNI mode on the coupler and HDG Mode on the autopilot console.

(2) For ILS Front Course Intercepts and Tracking:

Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and HDG mode on the Autopilot console.

(3) For LOC Back Course Intercepts and Tracking:

Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode with coupler and HDG mode on the Autopilot console.

SECTION 5 - PERFORMANCE

Installation of the AutoControl IIIB does not effect the basic Performance information presented by Section 5 of this handbook.

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SUPPLEMENT 8

FCS-810 AFCS WITHOUT FLIGHT DIRECTOR INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional FCS-810 with the FC-823E Flight Controller is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "DOA Approved" as a permanent part of this handbook based on Bendix STC No. SA429SO and must remain in this handbook at all times when the optional FCS-810 AFCS without Flight Director is installed.

NOTE

The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight tests was 24,000 feet.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Do not engage autopilot if airplane is out of trim.
(c) Maximum airspeed for autopilot operation is 213 KTS. IAS.
(d) During autopilot operation, the pilot must be in his seat with the safety belt fastened.
(e) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(f) During autopilot operation, the wing flaps must be fully retracted.
(g) Do not engage the altitude hold mode with vertical speeds in excess of 1500 feet per minute.

SECTION 3 - EMERGENCY PROCEDURES

(a) Autopilot
  (1) In the event a malfunction in the autopilot performance is detected, the pilot must immediately disengage the autopilot by momentarily pressing the TRIM/AUTOPILOT DISCONNECT SWITCH. This switch is on the left side of the pilot's control wheel.
  (2) Maximum altitude loss during malfunction tests in the following flight configuration.
    a. Cruise, Climb, Descent — 160 feet
    b. ILS Approach (with all engine operating) — 100 feet
    c. ILS Approach (with one engine inoperative) — 100 feet

(b) Single-Engine Operation
   (1) Autopilot performance has been satisfactorily demonstrated during simulated failure of one engine. In the event that the pilot elects to continue single-engine operation with autopilot, disengage the autopilot; re-trim the aircraft for single-engine operation; and re-engage the autopilot.
   (2) Do not initiate single-engine go-around in coupled GA mode. After aircraft is stabilized and trimmed out in single-engine climb, autopilot may be engaged.

(c) Pitch Trim
   (1) If trim warning light illuminates in flight, or if electric trim runs at any time without actuating the trim switch, turn trim ON-OFF switch OFF, pull the pitch trim circuit breaker, and have system inspected prior to operation.
   (2) If the trim circuit breaker releases, or the trim follow-up becomes inoperative during autopilot operation, disengage the autopilot and pull the trim circuit breaker.

SECTION 4 - NORMAL OPERATING PROCEDURES

(a) Manual Electric Trim

Manual electric trim is provided as standard equipment with the autopilot installation. The manual electric trim system is powered through the aircraft master switch, and a trim ON-OFF switch, located on the left side of the pilot's control wheel, both of which must be on for electric trim operation. A circuit breaker, located on the circuit breaker panel, provides circuit protection. Electric trim is obtained by actuating the electric trim switch on the pilot's control wheel in the desired direction.

PRE-FLIGHT

(a) Autopilot
   (1) Turn the autopilot master switch to "ON."
   (2) Check attitude gyro for proper erection. Set the directional gyro, if manual slaving type.
   (3) Depress the Pitch SYNC Button to center trim indicator.
   (4) Engage the autopilot; apply a force to the controls (one axis at a time) to determine if the autopilot may be overpowered.
   (5) Press HDG, NAV, APPR, ALT, GS PUSH MAN, and REV buttons, one at a time, and check respective lights on flight controller for proper operations.

(b) Manual Electric Trim
   (1) Trim Warning Light - OUT
   (2) Actuate electric trim switch and observe proper direction of movement of manual trim crank - CHECK
   (3) Manual Trim Crank Freedom of Movement - CHECK
   (4) Press the press-to-test button in the area of trim warning light. Light should light while being pressed and trim should not run. If trim runs, or if light does not illuminate, turn trim ON-OFF switch OFF, pull trim circuit breaker, and do not reset until the problem has been corrected.
   (5) Turn trim ON-OFF switch to OFF. Push trim switch to UP or DN. Trim should not run.
   (6) Turn TRIM ON-OFF switch ON.
   (7) Recheck aircraft pitch trim prior to takeoff.

IN-FLIGHT

NOTE

When engaging the autopilot, the pitch synchronizer will automatically stabilize the aircraft in the pitch attitude existing at the time of engagement.

(a) Engagement
   (1) Manually adjust aircraft trim in WINGS-LEVEL attitude prior to engaging autopilot. Press the AP ENGAGE BUTTON which will light upon engagement. To climb, actuate the pitch rocker switch to UP. To descend, actuate the pitch rocker switch to DN.
   (2) PITCH SYNC BUTTON - Pressing and holding the PITCH SYNC button, located on the pilot's wheel, disengages the pitch axis to allow the pilot to manually change the aircraft pitch attitude. The pitch trim indicator, when centered, indicates to the pilot that the autopilot has synchronized to the aircraft pitch attitude. While the PITCH SYNC button is depressed, manual electric trim may be actuated without disengaging the autopilot. When the PITCH SYNC button is released, the pitch axis will again engage, synchronized to the new pitch attitude. SYNC will cancel GS, ALT, or GA modes.

(b) Automatic Pitch Trim
   Automatic pitch trim is provided whenever the autopilot is engaged. Any attempt to overpower the autopilot pitch axis will cause the pitch trim to oppose the applied force, resulting in an out-of-trim condition.

(c) Manual Electric Trim/AP Disengage
   During normal AP operations, actuation of the trim switch in either direction disconnects AP and electric trim is immediately available. The electric trim system design is such that a single fault, other than a stuck switch will not cause a runaway trim. Other faults will be indicated by the trim warning light or by a pre-flight check. Illumination of the trim warning light indicates that a single fault has occurred, but trim will not run away. (See Emergency Pitch Trim Procedures.)

(d) Altitude Hold

The ALT button may be depressed at any time the vertical speed is less than 1500 feet per minute. Aircraft pressure altitude will be held when the autopilot altitude hold is engaged. Momentarily actuating the pitch rocker switch in either direction, engagement of the glide slope, or pressing the PITCH SYNC switch disengages the altitude hold function.

NOTE

The altitude controller attempts to maintain the aircraft at the selected altitude by changing the pitch attitude of the aircraft. The human pilot must then maintain power settings to assure a safe airspeed. In level flight, the autopilot should hold altitude within 20 feet of the pre-selected altitude; however, during turns there may be altitude excursions greater than 20 feet, but in no instance should the excursions be greater than 100 feet.

NOTE

If for any reason the selected altitude is deviated from by approximately 300 feet, the altitude controller will recycle to the new altitude.

(e) Heading Mode

The heading knob on the Horizontal Situation Display (HSD) or DG may be used to select a heading prior to pushing the HDG button. When the HDG button is pressed, the button will light and the aircraft will turn to the selected heading in the direction which is less than 180°, and at a bank angle of no more than 25°.

(f) En Route Navigation

NOTE

There are two methods of intercepting a VOR radial.

(1) Variable Intercept Angle - With this method, the pilot may preselect any intercept angle desired.

a. After identifying desired omni station, select desired omni course by rotating the CRS knob on the HSD or NAV indicator until the course select pointer aligns with the desired omni course.
b. Position the heading bug to select the desired intercept angle by rotating the HDG knob on the HSD or DG. The number of degrees between the course select pointer and the heading bug is the intercept angle. The pilot should not select an intercept angle less than 20°, or more than 90°.

c. Simultaneously press HDG and NAV buttons on the controller. HDG and NAV buttons will light. The aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume a normal 45° intercept angle.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the heading bug must be reset to the same heading as the course select pointer when the HDG light goes out.

(2) Fixed Intercept Angle

a. After identifying the desired omni station, select desired omni course on the HSD or NAV indicator by rotating the CRS knob until the course select pointer aligns with the desired omni course.

b. Press the NAV button. Button light comes on. Aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the selected omni bearing. If the omni bearing selected is less than 120° from the aircraft heading when the NAV mode is selected, the aircraft will turn toward the selected omni course. At angles of 120° or greater, the aircraft will turn away from the selected omni course and continue to turn through the larger angle until a proper intercept angle is established. In either case, the aircraft will assume an intercept course which will be no greater than 45° to the selected omni course.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the heading bug must be set to the same heading as the course select pointer.

(g) Automatic Approach Coupler

NOTE

There are two methods of intercepting the localizer.

(1) Variable Intercept Angle - This method is recommended when being vectored toward the localizer, by approach control, with the HDG and APPR modes engaged.

a. Align course arrow with the published inbound course by rotating the CRS knob on the HSD or NAV indicator.

b. Position the heading bug to select the desired intercept angle by rotating the HDG knob on the HSD or DG.

c. Simultaneously press HDG and APPR buttons on the controller. HDG and APPR buttons will light. Aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume a normal 45° intercept angle.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the heading bug must be reset to the same heading as the course select pointer when the HDG light goes out.

(2) Fixed Intercept Angle

a. Align the course select pointer with the published inbound course by rotating the CRS knob on the HSD or NAV indicator.

b. Press the APPR button on the controller. The APPR button will light and aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the localizer inbound heading. Aircraft will automatically assume an intercept course of no more than 45° to the localizer. For the reason explained in Paragraph (f) (2) b., do not select APPR until the aircraft heading is less than 120° from the localizer inbound heading.

NOTE

If the NAV indicator is not equipped with a course datum synchro, the heading bug must be set to the same heading as the course select pointer.

(3) Glide Slope

a. Automatic Engage

Glide slope is automatically armed and the aircraft will bracket the glide slope and begin a rate of descent commensurate with the glide slope angle and airspeed, providing the following conditions are met:

1. The APPR button is pressed.
2. The glide slope pointer is centered.
3. Aircraft is established on localizer beam at least 20 seconds prior to glide slope interception.

b. Manual Engage

If desired, glide slope may be captured manually by actuating glide slope button when glide slope pointer centers, provided the aircraft is in approach mode.

c. Glide Slope Mode

1. When the aircraft couples to the glide slope signal, the GS PUSH MAN light on the controller will light, and ALT light extinghishes.
2. Glide slope may be disengaged while flying the localizer by pressing ALT, HDG or NAV button on the controller; actuating pitch rocker switch; depressing the GA button; or pitch SYNC button.

d. Back Course Localizer

For a back course localizer approach, select the localizer front course inbound heading. Press REV button on controller. Both APPR and REV button lights will light, indicating to the pilot that he is in both the localizer and reverse modes.

e. Go-Around

Go-around switch may be pressed any time the pilot decides not to continue the approach to landing. Pressing the GA switch will cause the aircraft to automatically assume a pitch attitude of approximately eight degrees nose-up. (Pilot must adjust power settings to maintain airspeed.) Aircraft will continue to track localizer. GA light on controller will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to the selected heading, and remain in a pitch-up attitude of approximately eight degrees. Movement of the pitch rocker switch, pressing the pitch SYNC button, or ALT button will disengage the GA mode.

f. AP Release Switch

If the approach is carried to completion, the Trim/Autopilot Disconnect switch must be momentarily pressed prior to landing, thus disconnecting the automatic pilot and returning the aircraft to manual control for completion of the landing.

SECTION 5 - PERFORMANCE

Installation of the FCS-810 AFCS does not effect the basic Performance information presented by Section 5 of this handbook.

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SUPPLEMENT 9

FCS-810 AFCS WITH FLIGHT DIRECTOR INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional FCS-810 with the FC-823F Flight Controller is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "DOA Approved" as a permanent part of this handbook based on Bendix STC No. SA429SO and must remain in this handbook at all times when the optional FCS-810 AFCS with Flight Director is installed.

NOTE

The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight tests was 24,000 feet.

SECTION 2 - LIMITATIONS

(a) Autopilot OFF during takeoff and landing.
(b) Do not engage autopilot if airplane is out of trim.
(c) Maximum airspeed for autopilot operation is 213 KTS IAS.
(d) During autopilot operation, the pilot must be in his seat with the safety belt fastened.
(e) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(f) During autopilot operation, the wing flaps must be fully retracted.
(g) Do not engage the altitude hold mode with vertical speeds in excess of 1500 feet per minute.

SECTION 3 - EMERGENCY PROCEDURES

(a) Autopilot

(1) In the event a malfunction in the autopilot performance is detected, the pilot must immediately disengage the autopilot by momentarily pressing the TRIM/AUTOPILOT DISCONNECT SWITCH. This switch is on the left side of the pilot's control wheel.

(2) Maximum altitude loss during malfunction tests in the following flight configuration.

a.	Cruise, Climb, Descent	160 feet
b.	ILS Approach (with all engine operating)	100 feet
c.	ILS Approach (with one engine inoperative)	100 feet

(b) Single-Engine Operation

(1) Autopilot performance has been satisfactorily demonstrated during simulated failure of one engine. In the event that the pilot elects to continue single-engine operation with autopilot, disengage the autopilot; re-trim the aircraft for single-engine operation; and re-engage the autopilot.

(2) Do not initiate single-engine go-around in coupled GA mode. After aircraft is stabilized and trimmed out in single-engine climb, autopilot may be engaged.

(c) Pitch Trim

(1) If trim warning light illuminates in flight, or if electric trim runs at any time without actuating the trim switch, turn trim ON-OFF switch OFF, pull the pitch trim circuit breaker, and have system inspected prior to operation.

(2) If the trim circuit breaker releases, or the trim follow-up becomes inoperative during autopilot operation, disengage the autopilot and pull the trim circuit breaker.

SECTION 4 - NORMAL OPERATING PROCEDURES

(a) Manual Electric Trim

Manual electric trim is provided as standard equipment with the autopilot installation. The manual electric trim system is powered through the aircraft master switch, and a trim ON-OFF switch, located on the left side of the pilot's control wheel, both of which must be on for electric trim operation. A circuit breaker, located on the circuit breaker panel, provides circuit protection. Electric trim is obtained by actuating the electric trim switch on the pilot's control wheel in the desired direction.

PRE-FLIGHT

(a) Flight Director - Autopilot
   (1) FD/AP MASTER SWITCH - Turn FD/AP Master Switch to ON.
   (2) The Flight Director incorporates a Director Horizon in lieu of the conventional Artificial Horizon. In addition to supplying attitude information to the computer the Director Horizon displays commands which receive information from the computer in the same manner as the autopilot servos. By maneuvering the aircraft to satisfy the commands, the pilot is acting in the same manner as the autopilot servos.
   (3) Adjust pitch command or depress pitch SYNC button to align the commands with the fixed reference of the Director Horizon.
   (4) BEFORE TAKEOFF - Engage the autopilot, apply a force to the controls (on one axis at a time) to determine if the autopilot may be overpowered.
      a. Press HDG, NAV, APPR, ALT, GS PUSH MAN, and REV buttons one at a time, and check respective lights on the Flight Controller for operation.

(b) Manual Electric Trim
   (1) Trim Warning Light - OUT
   (2) Actuate electric trim switch and observe proper direction of movement of manual trim crank - CHECK
   (3) Manual Trim Crank Freedom of Movement - CHECK
   (4) Press the press-to-test button in the area of trim warning light. Light should light while being pressed and trim should not run. If trim runs, or if light does not illuminate, turn trim ON-OFF switch OFF, pull trim circuit breaker, and do not reset until the problem has been corrected.
   (5) Turn trim ON-OFF switch to OFF. Push trim switch to UP or DN. Trim should not run.
   (6) Turn TRIM ON-OFF switch ON.
   (7) Recheck aircraft pitch trim prior to takeoff.

IN-FLIGHT

NOTE

When engaging the autopilot, the pitch synchronizer will automatically stabilize the aircraft in the pitch attitude existing at the time of engagement.

(a) Engagement
   (1) Manually adjust aircraft trim in WINGS-LEVEL attitude prior to engaging autopilot. Press the AP ENGAGE BUTTON which will light upon engagement. To climb, actuate the pitch rocker switch to UP. To descend, actuate the pitch rocker switch to DN.
   (2) PITCH SYNC BUTTON - Pressing and holding the PITCH SYNC button, located on the pilot's wheel, disengages the pitch axis to allow the pilot to manually change the aircraft pitch attitude. The pitch trim indicator, when centered, indicates to the pilot that the autopilot has synchronized to the aircraft pitch attitude. While the PITCH SYNC button is depressed, manual electric trim may be actuated without disengaging the autopilot. When the PITCH SYNC button is released, the pitch axis will again engage, synchronized to the new pitch attitude. SYNC will cancel GS, ALT, or GA modes.

(b) Automatic Pitch Trim

Automatic pitch trim is provided whenever the autopilot is engaged. Any attempt to overpower the autopilot pitch axis will cause the pitch trim to oppose the applied force, resulting in an out-of-trim condition.

(c) Manual Electric Trim/AP Disengage

During normal AP operations, actuation of the trim switch in either direction disconnects AP and electric trim is immediately available. The electric trim system design is such that a single fault, other than a stuck switch will not cause a runaway trim. Other faults will be indicated by the trim warning light or by a pre-flight check. Illumination of the trim warning light indicates that a single fault has occurred, but trim will not run away. (See Emergency Pitch Trim Procedures.)

(d) Altitude Hold

The ALT button may be depressed at any time the vertical speed is less than 1500 feet per minute. Aircraft pressure altitude will be held when the autopilot altitude hold is engaged. Momentarily actuating the pitch rocker switch in either direction, engagement of the glide slope, or pressing the PITCH SYNC switch disengages the altitude hold function.

NOTE

The altitude controller attempts to maintain the aircraft at the selected altitude by changing the pitch attitude of the aircraft. The human pilot must then maintain power settings to assure a safe airspeed. In level flight, the autopilot should hold altitude within 20 feet of the pre-selected altitude; however, during turns there may be altitude excursions greater than 20 feet, but in no instance should the excursions be greater than 100 feet.

NOTE

If for any reason the selected altitude is deviated from by approximately 300 feet, the altitude controller will recycle to the new altitude.

(e) Heading Mode

The heading knob on the Horizontal Situation Display (HSD) may be used to select a heading prior to pushing the HDG button. When the HDG button is pressed, the button will light and the aircraft will turn to the selected heading in the direction which is less than 180°, and at a bank angle of no more than 25°.

(f) En Route Navigation

NOTE

There are two methods of intercepting a VOR radial.

(1) Variable Intercept Angle - With this method, the pilot may preselect any intercept angle desired.

a. After identifying desired omni station, select desired omni course by rotating the CRS knob on the HSD until the course select pointer aligns with the desired omni course.

b. Position the heading bug to select the desired intercept angle by rotating the HDG knob on the HSD. The number of degrees between the course select pointer and the heading bug is the intercept angle. The pilot should not select an intercept angle less than 20°, or more than 90°.

c. Simultaneously press HDG and NAV buttons on the controller. HDG and NAV buttons will light. The aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume a normal 45° intercept angle.

(2) Fixed Intercept Angle

a. After identifying the desired omni station, select desired omni course on the HSD by rotating the CRS knob until the course select pointer aligns with the desired omni course.

b. Press the NAV button. Button light comes on. Aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the selected omni bearing. If the omni bearing selected is less than 120° from the aircraft heading when the NAV mode is selected, the aircraft will turn toward the selected omni course. At angles of 120° or greater, the aircraft will turn away from the selected omni course and continue to turn through the larger angle until a proper intercept angle is established. In either case, the aircraft will assume an intercept course which will be no greater than 45° to the selected omni course.

(g) Automatic Approach Coupler

NOTE

There are two methods of intercepting the localizer.

(1) Variable Intercept Angle - This method is recommended when being vectored toward the localizer, by approach control, with the HDG and APPR modes engaged.

a. Align course arrow with the published inbound course by rotating the CRS knob on the HSD.

b. Position the heading bug to select the desired intercept angle by rotating the HDG knob on the HSD.

c. Simultaneously press HDG and APPR buttons on the controller. HDG and APPR buttons will light. Aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time, the HDG button light on the controller will go out and the aircraft will assume a normal 45° intercept angle.

(2) Fixed Intercept Angle

a. Align the course select pointer with the published inbound course by rotating the CRS knob on the HSD.

b. Press the APPR button on the controller. The APPR button will light and aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the localizer inbound heading. Aircraft will automatically assume an intercept course of no more than 45° to the localizer. For the reason explained in Paragraph (f) (2) b., do not select APPR until the aircraft heading is less than 120° from the localizer inbound heading.

(3) Glide Slope

a. Automatic Engage

Glide slope is automatically armed and the aircraft will bracket the glide slope and begin a rate of descent commensurate with the glide slope angle and airspeed, providing the following conditions are met:

1. The APPR button is pressed.
2. The glide slope pointer is centered.
3. Aircraft is established on localizer beam at least 20 seconds prior to glide slope interception.

b. Manual Engage

If desired, glide slope may be captured manually by actuating glide slope button when glide slope pointer centers, provided the aircraft is in approach mode.

c. Glide Slope Mode

1. When the aircraft couples to the glide slope signal, the GS PUSH MAN light on the controller will light, and ALT light extinghishes.
2. Glide slope may be disengaged while flying the localizer by pressing ALT, HDG or NAV button on the controller; actuating pitch rocker switch; depressing the GA button; or pitch SYNC button.

d. Back Course Localizer

For a back course localizer approach, select the localizer front course inbound heading. Press REV button on controller. Both APPR and REV button lights will light, indicating to the pilot that he is in both the localizer and reverse modes.

e. Go-Around

Go-around switch may be pressed any time the pilot decides not to continue the approach to landing. Pressing the GA switch will cause the aircraft to automatically assume a pitch attitude of approximately eight degrees nose-up. (Pilot must adjust power settings to maintain airspeed.) Aircraft will continue to track localizer. GA light on controller will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to the selected heading, and remain in a pitch-up attitude of approximately eight degrees. Movement of the pitch rocker switch, pressing the pitch SYNC button, or ALT button will disengage the GA mode.

f. AP Release Switch

If the approach is carried to completion, the Trim/Autopilot Disconnect switch must be momentarily pressed prior to landing, thus disconnecting the automatic pilot and returning the aircraft to manual control for completion of the landing.

SECTION 5 - PERFORMANCE

Installation of the FCS-810 AFCS does not effect the basic Performance information presented by Section 5 of this handbook.

SUPPLEMENT 10

ALTIMATIC X AUTOPILOT OR FLIGHT DIRECTOR AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement must be used in conjunction with the FAA Approved Pilot's Operating Handbook, dated 10-1-75 when Piper Altimatic X Autopilot Model AK684 or Altimatic X Flight Director Autopilot Model AK684FD is installed in accordance with STC SA3209SW-D. The information contained herein supplements the information of the basic Pilot's Operating Handbook; for limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the Altimatic X Autopilot or Flight Director Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) The maximum speed for autopilot operation is 195 KIAS (Autopilot Vmo).
(b) Flap extension limited to 1/4 down during autopilot operation.
(c) Autopilot OFF for takeoff and landing.
(d) Placard, "Conduct trim check prior to flight (See POH)," to be installed in clear view of pilot.

SECTION 3 - EMERGENCY PROCEDURES

3.1 AUTOPILOT

This aircraft is equipped with a Master Disconnect/Interrupt Switch on the pilot's control wheel. When the switch button is depressed it will disconnect the autopilot, and the yaw damper if installed and operating. When depressed and held it will interrupt all electric elevator trim operations. Trim operations will be restored when the switch is released. If an autopilot or trim emergency is encountered, do not attempt to determine which system is at fault. Immediately depress and hold the master disconnect/interrupt button. Turn off autopilot, trim master switch off and retrim aircraft, then release the interrupt switch.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breakers for both systems.

(a) In the event of an autopilot malfunction the autopilot can be:
   (1) Overpowered at either control wheel.

CAUTION

Do not overpower autopilot pitch axis for periods longer than 3 seconds because the autotrim system will operate in a direction to oppose the pilot and will, thereby, cause an increase in the pitch overpower forces.

   (2) Disconnected by depressing the master disconnect/interrupt switch.
   (3) Disconnected by depressing the trim switch "AP OFF" bar.
   (4) Disconnected by pushing the AP ON-OFF annunciator switch on the autopilot programmer.

(b) ALTITUDE LOSS DURING MALFUNCTION
   (1) An autopilot malfunction during cruise with a 3 second delay in recovery initiation could result in as much as 55° of bank and 300' of altitude loss.
   (2) An autopilot malfunction during a high altitude descent at Vmo with a 3 second delay in recovery initiation could result in as much as 30° bank and 500' altitude loss.
   (3) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 18° bank and 60' altitude loss. Maximum altitude loss measured in approach configuration gear down and operating either coupled or uncoupled, single or multi-engine.

(c) SINGLE ENGINE OPERATIONS - AUTOPILOT MODE
   (1) Engine failure during an autopilot approach operation: Disengage autopilot conduct remainder of approach manually.
   (2) Engine failure during go around: Disengage autopilot, retrim aircraft, perform normal aircraft engine out procedures then re-engage autopilot.
   (3) Engine failure during normal climb, cruise, descent: Retrim aircraft, perform normal aircraft engine out procedures.
   (4) Maintain aircraft yaw trim throughout all single engine operations.

NOTE

Proper autopilot performance requires that the aircraft trim be maintained.

3.2 TRIM SYSTEM

(a) In the event of a trim malfunction:
   (1) Depress and hold the master disconnect/interrupt switch.
   (2) Trim master switch - OFF. Retrim aircraft as necessary using manual trim system.
   (3) Release master interrupt switch - be alert for possible trim action.
   (4) Trim circuit breaker - Pull. Do not operate trim until problem is corrected.

(b) If a trim runaway occurs with the autopilot operating, the above procedures will disconnect the autopilot which will immediately result in higher control wheel forces. Be prepared to manually retrim, as necessary to eliminate undesirable forces.

3.3 COMPASS SYSTEM

(a) Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

(1) Appearance of HDG Flag:
  a. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
  b. Check compass circuit breaker.
  c. Observe display for proper operation.

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

(3) With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(4) Slaving Failure - (i.e. failure to self correct for gyro drift):
  a. Check gyro slaving switch is set to No. 1 position. (If equipped with Slave No. 1 - No. 2 switch.)
  b. Check for HDG Flag.
  c. Check compass circuit breaker.
  d. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

  e. Select slaving amplifier No. 2 (gyro slaving switch is set to No. 2 position).
  f. Reset heading card while checking slaving meter.
  g. Switch to free gyro mode and periodically set card as with an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

4.1 SYSTEM DESCRIPTION

The Altimatic X Autopilot utilizes three axis sensing with two surface control to provide roll and pitch axis stabilization. The autopilot system also provides lateral and vertical radio coupling and command or automatic elevator pitch trim. A yaw damper providing rudder surface control is optional as an independent sub-system.

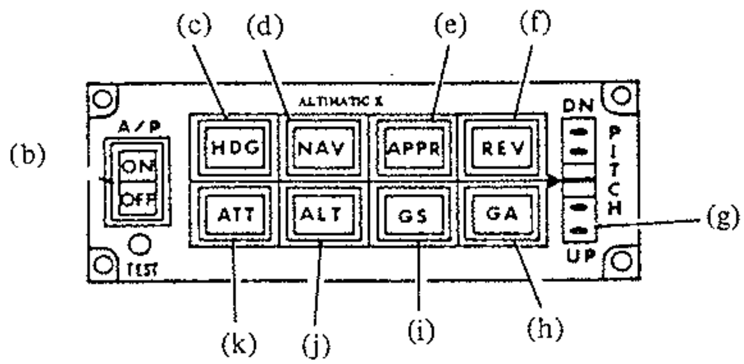
The Altimatic X is available as an integrated flight director and autopilot system by the use of one of the two optional Attitude Direction Indicators (A.D.I.) offered.

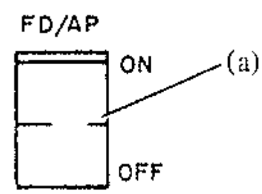
The system utilizes a separate master ON-OFF switch for autopilot and flight director power control. Mode selection is made by pushing the desired mode switch on the mode programmer. All mode annunciators are lighted on the programmer with the operating (selected) modes lighted to a higher brilliance than the others.

During night operation, the programmer annunciator light level is controlled by the pilot's instrument lamp control and light brilliance will track the light level selected for the flight instruments.

The electric trim system is powered through a separate system master switch that must be "ON" during autopilot operation.

4.2 COCKPIT CONTROL AND FUNCTIONS





(a) System Master Switch - Master power switch which must be "ON" for flight director and/or autopilot operation.

(b) Autopilot ON-OFF Switch - Pedestal mounted push ON - push OFF switch to engage or disengage autopilot (servos). Altimatic X Systems are available as integrated flight director - autopilot systems only, without the optional Attitude Director Instrument (A.D.I.).

NOTE

Altimatic X systems without the optional A.D.I. will always return to HDG and ATT modes when the autopilot is disengaged. The autopilot (only) version may be pre-programmed to any lateral mode prior to engagement, however the pitch mode will always revert to "ATT" during autopilot engagement. Systems with an A.D.I. (flight director) will not change modes during autopilot engage-disengage when flight director display is "ON". When the autopilot is engaged there will be approximately a 1 second lag during synchronization cycle.

(c) HDG (Heading) Mode Selector - provides turn control through use of the heading indice (bug) on the H.S.I. heading instrument.

(d) NAV (Navigation) Mode Selector - provides automatic 45° VOR intercept; tracking and crosswind correction for cross country VOR tracking. Utilizes information from H.S.I. VOR course indicator and left-right needle. (HDG bug is disabled during operation in NAV - APPR - REV modes.) Select desired course on H.S.I. Omni Bearing Selector (O.B.S.) and then select NAV mode.

(e) APPR (Approach) Mode Selector - provides automatic 45° VOR/LOC intercept angle, tracking and crosswind correction for use during instrument approach maneuver. Select desired course on H.S.I. Omni Bearing Selector (OBS) and then select APPR mode.

(f) REV (Reverse) Mode Selector - For use in tracking LOC Front course outbound or LOC Back course inbound to airfield. Always set inbound front course bearing on O.B.S. when using REV mode.

(g) Pitch Command Disc - Controls aircraft climb and dive attitude when operating in ATT mode. System limits maximum angle to 15°, or less. When the autopilot is engaged in ATT mode, automatic pitch synchronization will be provided to match autopilot command position to aircraft attitude.

(h) GA (Go Around) Mode Selector - provides a pre-selected pitch up attitude which will provide approximate single-engine best rate of climb speed during single-engine operation. During multi-engine operation this attitude will provide a comfortable go-around angle and cruise climb airspeed. GA mode may be operated remotely from the left engine throttle switch located in the throttle knob.

(i) GS (Glide Slope) Mode Selector - GS mode will arm (illuminate) automatically during ILS approaches when the aircraft is under the GS center line and the system is in APPR and ALT modes. When GS center line is reached the ALT annunciator will extinguish, indicating GS capture. When operating above the GS center line, within 80% of full scale, manual GS arming and engaging may be obtained by selecting GS from any pitch mode.

NOTE

When over 80% full scale, selection of GS will automatically cause engagement of ALT mode. In addition, any time a GS offset of 80%, or more, above the GS occurs, the system will automatically revert to ALT mode to preclude diving to the GS.

(j) ALT (Altitude Hold) Mode Selector - Selection of ALT mode will cause the autopilot to maintain the pressure level (altitude) at the point of engagement. For maximum passenger comfort the rate of climb or descent should be reduced to approximately 500 FPM with the pitch disc prior to ALT hold engagement.

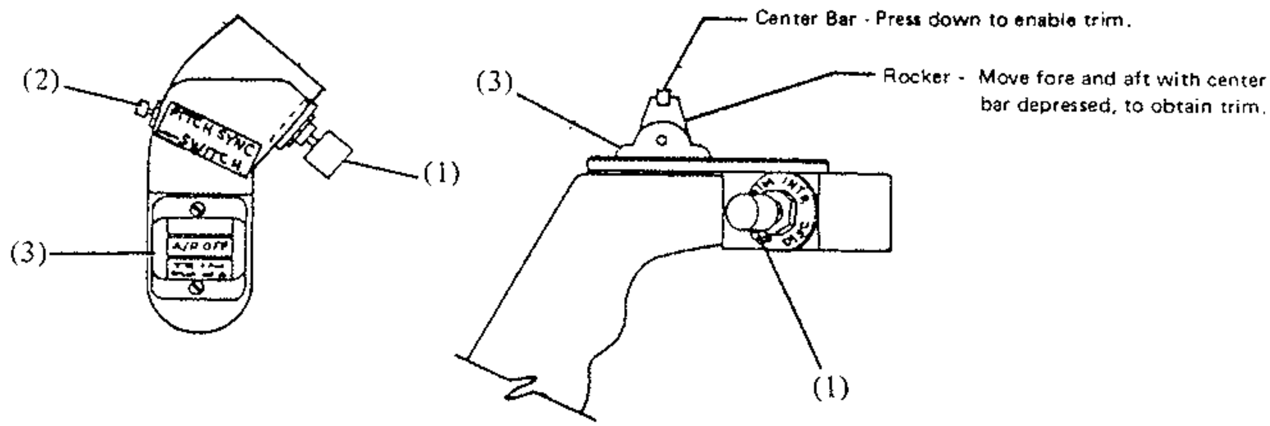
(k) ATT (Attitude) Mode Selector - provides attitude control through pitch command disc (item g). Automatic synchronization is provided when autopilot is engaged in ATT mode. For autopilot (only) system, roll and pitch modes will revert to HDG and ATT any time the autopilot is disengaged and pitch synch will be provided any time the autopilot is engaged.

(l) SPECIAL MODES OR OPERATIONS

(1) Selected angle intercepts may be obtained during VOR or ILS intercept situations, i.e. radar vectors to final approach, by selecting HDG and APPR mode simultaneously when the VOR-LOC needle is displaced 60% full scale or more. In this condition, the system will follow the HDG indice (bug) until within 60% of "on course" at which time the system will shift from HDG to APPR automatically. Selected angle intercepts of over 60° are not recommended.

(2) Pitch Synch Mode - The system is provided with a pitch synch switch on the left horn of the pilot's control wheel. When depressed, momentarily, the system will revert to ATT and automatic synchronization will occur before servo re-engagement. When depressed and held, the system will revert to ATT and the roll and pitch servos will be disengaged to allow maneuvering. When released, the servos will re-engage. The lateral (roll) modes will not be disturbed during pitch synch operation.

(m) CONTROL WHEEL SWITCHES

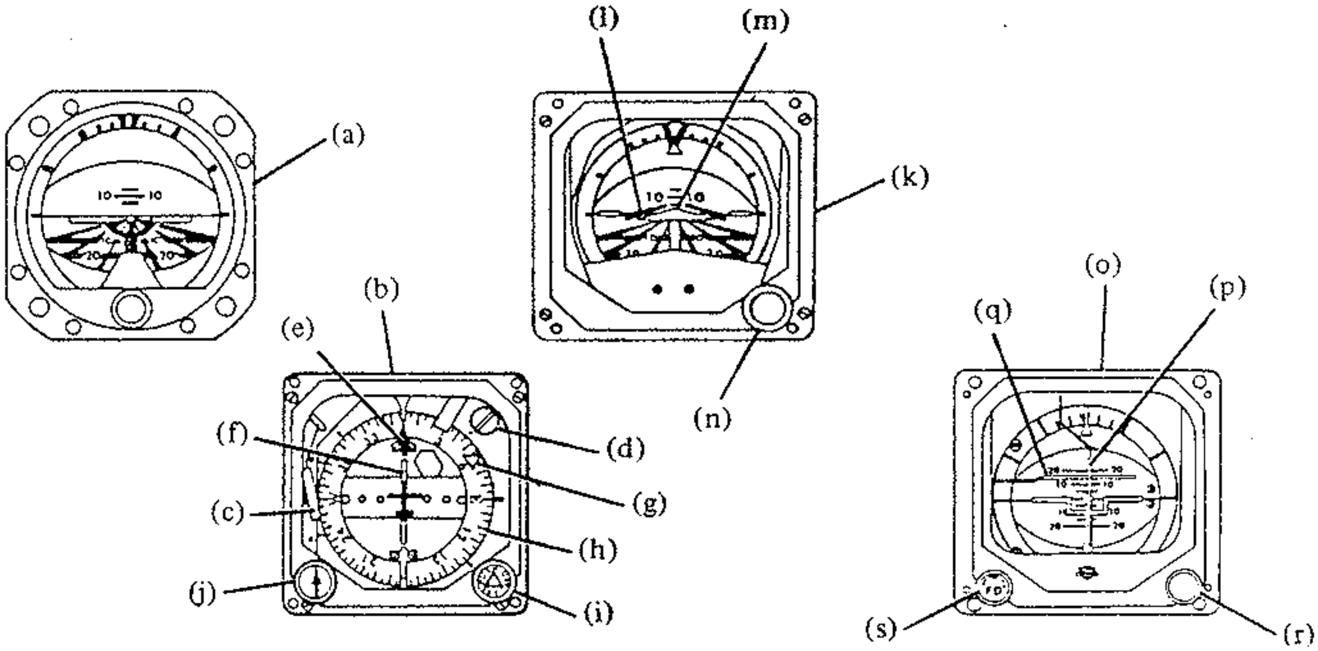


(1) Emergency Interrupt/Disconnect Switch - This switch will disconnect the autopilot and yaw damper when depressed. When depressed and held it will interrupt all electric elevator trim operations.

(2) Pitch Synch Switch - See explanation above.

(3) Command Trim Switch - Split action type trim switch requiring the top bar to be depressed and the switch rocked fore or aft for trim operation. Depressing the top bar will disconnect the autopilot (will not disconnect the yaw damper).

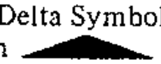
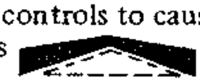
4.3 INSTRUMENTS



(a) Standard 3" Air Driven Attitude Indicator Gyro
(b) NSD 360A Compass System (shown) - For details of any other compass system, refer to manufacturer's information.
(c) G/S Indicator with Flag Alarm.
(d) Slaving Meter - Oscillation of needle indicates that compass is slaved to magnetic flux detector. Needle maintained in either extreme position for more than 2 - 3 minutes indicates system failure.

NOTE

NSD 360A System includes a slaving selector switch allowing the selection of free gyro mode. Refer to emergency procedures for failure instructions.

(e) VOR-LOC Bearing Selector Course Needle and Omni Bearing Indicator
(f) Left-right portion of VOR-LOC Course Needle
(g) HDG indice (bug) for autopilot or flight director HDG control.
(h) Compass card
(i) HDG Control Knob - push in to cage instrument for initial compass setting. (NSD 360A)
(j) VOR Course Needle Set Knob (O.B.S.)
(k) Optional flight director instrument (A.D.I.) providing single cue type steering display.
(l) Steering Command Bar - Raises and lowers for pitch commands and tilts to indicate bank direction and amount.
(m) Miniature Airplane (Delta Symbol) - Operate aircraft controls to cause aircraft to pitch or bank as necessary to position  inside steering bars  in order to satisfy computed steering commands.
(n) Miniature airplane elevation knob.

(o) Optional flight director instrument (A.D.I.) providing two-cue steering display.
(p) Vertical steering bar providing roll steering. To satisfy command, maneuver aircraft to keep vertical bar centered.
(q) Horizontal steering bar providing pitch steering. To satisfy command, maneuver aircraft to keep horizontal bar centered.
(r) Miniature aircraft elevation adjust.
(s) Flight director OFF switch to remove steering presentation from view during autopilot operation, if desired.

4.4 PRE-FLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (24.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that one engine be operated (minimum) to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(a) FLIGHT DIRECTOR
   (1) Check power - ON.
   (2) Programmer lights - press to test
   (3) Flight director switch on A.D.I. - ON. (Two-cue only)
   (4) Pitch disc DN - UP - check pitch steering indicator moves appropriately.
   (5) HDG indice RT - LT - check roll steering indicator moves appropriately.

(b) COMPASS SYSTEM (NSD 360A)
   (1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
   (2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
   (3) Perform standard VOR receiver check.
   (4) NAV - APPR - Engage NAV or APPR mode switch and observe steering bar indicates turn toward the VOR needle.

NOTE

If the Omni Bearing Selector is more than 45° from the aircraft heading, the flight director steering bar will only indicate a turn toward the omni bearing.

(c) AUTOPILOT
   (1) Engage autopilot.
   (2) Repeat flight director roll and pitch response check. Control wheel movement should correspond to HDG or pitch command input.

NOTE

Autopilot might not be able to raise aircraft elevator on the ground without assistance from the pilot.

(3) Grasp control wheel and override roll and pitch servo actuators to assure override capability.
(4) Hold control yoke and disengage autopilot by activating the control wheel emergency disconnect/interrupt switch.
(5) Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
(6) Retrim aircraft for takeoff.

(d) TRIM SYSTEM

This aircraft is equipped with a command trim system designed to withstand any type of single malfunction, either mechanical or electrical, without uncontrolled operation resulting. The pre-flight check procedure is designed to uncover hidden failures that might otherwise go undetected. Proper operation of the electric elevator trim system is predicated on conducting the following pre-flight check before each flight. If the trim system fails any portion of the procedure pull the trim circuit breaker and leave the circuit breaker out until trim system is repaired. Substitution of any trim system component for another model is not authorized. For emergency interrupt information, refer to EMERGENCY PROCEDURES Section of this supplement.

The command electric trim switch on the left portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the autopilot.
(2) When the top bar is pressed AND the rocker is moved forward, nose down trim will occur; when moved aft, nose up trim will occur.
(3) PRE-FLIGHT

Command Trim - Before Each Flight

a. Check trim circuit breaker - IN.
b. Trim master switch - ON.
c. AP OFF-Check normal trim operation - UP. Grasp trim control and check override capability. Check nose down operation. Recheck override. With trim operating, depress emergency interrupt/disconnect switch - trim operation should stop.
d. Activate center bar only - Push rocker fore and aft - only. Trim should not operate with either separate action.

Autotrim - Before Each Flight

a. AP ON - Check automatic operation by activating autopilot pitch command disc UP then DN. Observe trim operation follows pitch command direction.

NOTE

In autopilot mode, there will be approximately a 3 second delay between operation of pitch command and operation of trim.

b. Press center bar (AP OFF) - release - check autopilot disengagement.
c. Rotate trim control to check manual trim operation.
d. Recheck aircraft pitch trim to correct takeoff position after autopilot and trim system check.

4.5 IN-FLIGHT PROCEDURE - FLIGHT DIRECTOR

(a) Altimatic X master switch - ON. Flight director switch on A.D.I. - ON, if appropriate.
(b) Adjust HDG indice to aircraft heading and select desired pitch attitude by movement of pitch command disc or by activation of pitch synch switch.
(c) Maneuver aircraft manually to satisfy the commands presented. Select other modes as desired, refer to Section 4.0 for mode description.

4.6 IN-FLIGHT PROCEDURE - AUTOPILOT/FLIGHT DIRECTOR AUTOPILOT

(a) Altimatic X master switch - ON. Flight director switch on A.D.I. - ON, if desired and equipped.
(b) Trim aircraft for existing flight condition (all axes). Engage autopilot.
(c) During maneuvering flight - control aircraft through use of the HDG indice and the pitch disc. (HDG-ATT modes)
(d) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Section 4.0. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information Section, 4.7.

4.7 SPECIAL OPERATIONS AND INFORMATION

ALTITUDE HOLD OPERATION

For best results, reduce rate of climb or descent to 500 FPM before engaging altitude hold mode.

INSTRUMENT APPROACH OPERATIONS

Initial and/or intermediate approach segments should be conducted between 104-122 KIAS with the flaps extended to the takeoff position. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 104-113 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch command disc in conjunction with power to maintain desired airspeed and descent rate.

NOTES

1. Automatic G/S disengagement will occur if a deviation above the G/S center line of 80%, or more, occurs after G/S capture. Automatic G/S disengagement will revert the autopilot to altitude hold mode.
2. Flight director or autopilot will not decouple from the G/S or Localizer in the event of radio failure. Monitor course guidance raw data during approach to assure signal quality.

INSTRUMENT APPROACH GO AROUND MANEUVER

At the decision height (DH) or missed approach point (MAP) perform the go-around as follows:

(a) Select G/A mode at the programmer or push the remote G/A switch, if installed.
(b) Add takeoff power, or power as desired.
(c) Check the correct attitude and that a positive rate of climb is indicated, then raise flaps and gear.
(d) Set desired HDG and select HDG mode for lateral maneuvering.

SECTION 5 - PERFORMANCE

Installation of the Altimatic X Autopilot or Flight Director Autopilot does not effect the basic Performance information presented by Section 5 of this handbook.

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SUPPLEMENT 11

KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM (WITHOUT FLIGHT DIRECTOR INSTALLATION)

SECTION 1 - GENERAL

This manual is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System as installed in the Aztec. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" as a permanent part of this handbook based on King STC No. SA1163CE and must remain in this handbook at all times when the optional King KFC 200 Automatic Flight Control System is installed.

The KFC 200 is certified in this airplane with two axis control - pitch and roll.

The airplane is equipped with an electric pitch trim system which is controlled by pilot operation of the trim switch. When autopilot coupled, the autopilot uses the electric trim system to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/manual electric pitch trim monitor is provided in the autopilot. Autotrim and/or manual electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

This airplane is equipped with a manual electric pitch trim system designed to withstand any type in-flight single malfunction provided that the system is fully functional during the preflight operational check.

ABBREVIATIONS

ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS (SYNC)	Control Wheel Steering or Synchronization
DISC	Disconnect
FCS	Flight Control System
FD	Flight Director System
FDI	Flight Director Indicator
GA	Go Around
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, pilot must be seated at the controls with seat belt fastened. Operation is restricted to the left-side pilot position.
(b) Maximum speed for autopilot operation is 200 KIAS.
(c) The autopilot must be disengaged during takeoff and landing.
(d) System approved for Category I operation only (APPR or BC selected).
(e) Autopilot attitude command limits:
Pitch ±15°
Roll ±25°
(f) The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight test was 14,000 feet for the non-turbo Aztec and 24,000 feet for the turbocharged Aztec. Operation of the autopilot above 14,000 feet without the installation of a KA 132 Acceleration switch is prohibited.
(g) Placards:
Location - Pilot's control wheel, left horn:

AP DISC TRIM INTERRUPT

- Pilot's control wheel, left horn:

CWS (SYNC)

- Pilot's control wheel, left horn:

TRIM UP/DN

- Left throttle lever:

GO AROUND

- Directly beneath the KI 525A PNI:

CONDUCT AFCS PREFLIGHT CHECK PRIOR TO FLIGHT IN ACCORDANCE WITH FLIGHT MANUAL.

- Immediately adjacent to the Acceleration Test Switch (Turbo Aztec only)

ACCEL
TEST
UP/DN

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT DISENGAGEMENT
Disengage the Autopilot and/or prevent engagement by:
(1) Pilot's AP DISC switch.
(2) AP engage lever on Mode Controller.
(3) Pulling the AUTOPILOT circuit breaker.
(4) Turning aircraft master switch OFF.
(5) Turning avionics master switch OFF.
(6) Actuating manual electric trim.

(b) AUTOMATIC AUTOPILOT DISENGAGEMENT

Any of the following will cause the autopilot to automatically disengage:

(1) External power failure.
(2) Internal Flight Control System failure.
(3) With KCS 55A system a loss of compass valid (displaying HDG flag) disengages the AP when a mode using heading information is engaged. With HDG flag present only AP and vertical modes can be selected.
(4) (Turbo Aztec only) In the event of an autopilot malfunction, the KA 132 Acceleration switch will disconnect the autopilot if the established "G" envelope is exceeded.

(c) MANUAL ELECTRIC PITCH TRIM

Manual electric pitch trim can be disengaged by pressing AP DISC/TRIM INTERRUPT switch and holding down until recovery can be made. Then turn off AVIONICS MASTER switch or ELEC TRIM switch, if installed, and manually retrim the airplane using the manual trim control crank. After the airplane is trimmed out, pull the (ELECTRIC TRIM) breaker and turn the AVIONICS MASTER switch back on.

NOTE

UNDER CERTAIN FLIGHT CONDITIONS THE MANUAL PITCH TRIM CRANK MAY NOT PROVIDE OVERRIDE CAPABILITY OVER THE ELECTRIC PITCH TRIM AUTHORITY WITH AUTOPILOT/ELECTRIC TRIM ENGAGED.

(d) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTION

	CONFIGURATION	ALT LOSS	ALT LOSS (Turbo Aztec)
(1)	Cruise, Climb, Descent	300′	450′
(2)	Maneuvering	50′	100′
(3)	APPR	10′	75′
(4)	SE APPR	10′	50′

(e) ENGINE FAILURE (Coupled)

(1) Disengage AP
(2) Follow basic Airplane Flight Manual single-engine procedures.

CAUTION

IF RUDDER TRIM CANNOT BE MAINTAINED WHEN POWER IS CHANGED DURING A SINGLE-ENGINE COUPLED APPROACH, DISENGAGE AUTOPILOT AND CONTINUE APPROACH MANUALLY.

CAUTION

WHEN THE AUTOPILOT IS ENGAGED, MANUAL APPLICATION OF A FORCE TO THE PITCH AXIS OF THE CONTROL WHEEL FOR A PERIOD OF THREE SECONDS OR MORE WILL RESULT IN THE AUTOTRIM SYSTEM OPERATING IN THE DIRECTION TO CREATE A FORCE OPPOSING THE PILOT. THIS OPPOSING MISTRIM FORCE WILL CONTINUE TO INCREASE AS LONG AS THE PILOT APPLIES A FORCE TO THE CONTROL WHEEL, AND WILL ULTIMATELY OVERPOWER THE AUTOPILOT. IF THE AUTOPILOT IS DISENGAGED UNDER THESE CONDITIONS, THE PILOT MAY BE REQUIRED TO EXERT CONTROL FORCES IN EXCESS OF 50 POUNDS TO MAINTAIN THE DESIRED AIRCRAFT ATTITUDE. THE PILOT WILL HAVE TO MAINTAIN THIS CONTROL FORCE WHILE HE MANUALLY RETRIMS THE AIRCRAFT.

SECTION 4 - NORMAL PROCEDURES

(a) The airplane MASTER SWITCH function is unchanged and can be used in an emergency to shut off all electrical power while the problem is isolated.
(b) The AVIONICS MASTER switch supplies power to the avionics bus bar of the radio circuit breakers, FD/AP and ELEC TRIM circuit breakers.
(c) The ELEC TRIM switch, if installed, controls power to the Manual Electric Trim and Autotrim systems.
(d) The KFC 200 is controlled by the following circuit breakers:

AUTOPILOT (FD /AP) - This supplies power to the KC 295 Flight Computer, KA 285 Annunciator Panel, KC 292 Mode Controller, and both AP servos.

AVIONICS MASTER (RADIO MASTER) - This in conjunction with the AVIONICS MASTER switch supplies power to the avionics bus.

COMP. SYSTEM (COMPASS) - This supplies power to the KCS 55A Compass System.

PITCH TRIM (ELEC. TRIM) - This supplies power to the FCS autotrim and manual electric pitch trim systems.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP and interrupt the power to the electric trim system. To resume AP control, the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed which removes all power from the trim system to allow the pilot time to turn off the AVIONICS MASTER switch or ELEC. TRIM switch and pull the (PITCH TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync the AP in PAH, or ALT hold mode. When the CWS is held depressed, manual electric pitch trim may be operated without disengaging the AP.

TRIM UP/DN - Manual electric pitch trim is activated by a dual-action type switch that requires both parts be moved simultaneouly for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller. (Except when CWS switch is held depressed as previously noted.)

FLAP OPERATION - Abrupt retraction of full flaps with automatic pilot engaged may cause momentary change in pitch attitude.

(f) FCS WARNINGS FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

HDG - This warning flag, mounted in the Pictorial Navigation Indicator, will be in view whenever the Directional Gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected, the AP is disengaged. Basic AP mode may then be re-engaged along with any vertical mode.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever autotrim and/or manual electric pitch trim failures occur: The trim servo motor running without a command is monitored on autotrim and manual electric trim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are monitored on autotrim only. The TRIM warning light will flash at least four times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glide Slope valid (GS pointer being in view on PNI) has to be present before GS may couple. If, after GS CPLD, the valid is lost the system will flash the GS Annunciator and revert from GS CPLD back to PAH. If the GS valid returns the system will revert back to GS CPLD.

NAV - The NAV or APPR Modes (ARM OR CPLD) may be selected and will function with or without a NAV warning flag present.

AP DISCONNECT ALERT - The Autopilot Disconnect Alerter will sound an audible warning for approximately two seconds whenever the Autopilot engage lever on the KC 292 Mode Controller is disengaged.

(g) BEFORE ENGAGING FLIGHT CONTROL SYSTEM
   (1) Verify that all circuit breakers for the system are in.
   (2) Allow sufficient time for the gyros to come up to speed and for the system to warm up (3-4 minutes).

(h) PREFLIGHT CHECK (Must be performed prior to each flight)
   (1) With no modes engaged and power applied to the system, depress the Test Button on the Mode Controller. All annunciators, except FD and GA, will be illuminated on the annunciator panel, including the three marker lights and the red TRIM failure light will flash. At least four or more flashes must be observed to indicate proper operation of the autotrim electric pitch trim feature and an audible warning should sound.

(2) Engage the AP, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP can be overpowered. Disconnect the AP by pressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.

(3) Check the operation of the pilot's control wheel switch functions.

(4) Disengage the A/P and, run the following manual electric pitch trim checks.

a. Verify that the ELEC TRIM circuit breaker is in.

b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run.
Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.

c. Run the trim from full nose up to full nose down. The time required shall be 37 + 4 seconds.

d. Grasping the manual trim crank, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the crank.)

e. Press the AP DISC/TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.

(5) Engage the AP and put in a pitch (UP) command using the vertical trim switch on the KC 292 Mode Controller. Hold the control column from moving and observe the autotrim run in the nose up direction after approximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose down direction after approximately three seconds.

(6) Engage the A/P and HDG modes. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.

CAUTION

DISENGAGE THE AP AND CHECK THAT THE AIRPLANE MANUAL PITCH TRIM IS IN THE TAKEOFF POSITION PRIOR TO TAKEOFF.

(i) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15°. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control while retaining his previous modes, and to conveniently resume that profile at his discretion.

(2) Disengage Procedure:
While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC switch, operating the manual electric pitch trim switch, or by disconnecting the AP engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off to indicate that the AP is disengaged.

(3) AUTOPILOT MODE (AP):
The AP must be engaged before any other mode can be engaged. The AP mode alone indicates PAH and wings level. The AP will automatically follow any other modes engaged. Disengaging the AP disengages all other modes.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC 292 MODE CONTROLLER PANEL), MAY BE USED TO TRIM THE PITCH ATTITUDE AT A RATE OF ONE DEGREE PER SECOND.

(4) Altitude Hold Mode (ALT):
When the AP is engaged and the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater then 500 feet per minute climb or descent. The ALT will automatically disengage when glide slope couples. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

THE "VERTICAL TRIM" SWITCH (LOCATED ON THE KC 292 MODE CONTROLLER PANEL), MAY BE USED TO CHANGE OR TRIM THE ALTITUDE UP OR DOWN AT 500 TO 700 FPM WITHOUT DISENGAGING THE MODE. THE ALTITUDE EXISTING WHEN THE SWITCH IS RELEASED WILL THEN BE HELD.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, engage the AP, and depress the HDG switch on the Mode Controlled and AP and HDG will be displayed on the annunciator panel. The airplane will turn to the heading selected and hold. The pilot may then choose any new heading by merely setting the bug on a new heading. The airplane will automatically turn in the direction the heading bug is turned. To disengage the HDG Mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator panel. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial, engaging the AP and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until intercepting the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or AP mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or APPR when in NAV CPLD/ARM.

CAUTION

THE "NAV" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading, engaging the AP, and depressing the APPR switch on the Mode Controller. The annunciator will indicate AP and APPR ARM until intercepting the course unless the APPR switch is engaged with the wings level and there is a centered needle on the CDI. Then the mode will go directly to APPR CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPROACH mode can be disengaged by depressing the APPR switch on the Mode Controller, or by engaging HDG or NAV when in APPR CPLD. The annunciator panel indicates the status of the approach mode.

CAUTION

THE "APPR" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(8) Back Course Mode (BC):
For BC operation proceed as for normal approach mode, but engage BC after selecting APPR. The BC switch reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC or APPR switches, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(j) VOR PROCEDURES
(1) Tune NAV receiver to the appropriate frequency.
(2) Set the desired heading with the HDG bug to intercept the radial and engage AP and HDG.
(3) Select the desired radial and engage NAV. The airplane will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(k) APPROACH PROCEDURES
  (1) Tune ILS or VOR.
  (2) Set CDI to front course.
  (3) Set Heading Bug and with AP engaged, engage HDG to intercept course beam at any angle up to 90°.
  (4) Engage APPR and note APPR ARM on the annunciator panel.
  (5) When the airplane approaches the beam; APPR will couple; HDG will decouple; airplane will track LOC or VOR; and CPLD will illuminate on the annunciator panel.
  (6) When the glide slope beam is intercepted, the glide slope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. Airplane will now track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.
  (7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

OPERATION OF THE MARKER TEST FUNCTION AFTER APPROACH COUPLED WILL REDUCE THE FLIGHT CONTROL SYSTEM GAINS. IF THIS SHOULD OCCUR, THE APPROACH MODE SHOULD BE RECYCLED.

  (8) Landing or missed approach.
    a. Landing: disengage AP and land.
    b. Missed Approach: disengage AP and perform missed approach procedure as per Flight Manual.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the MODE CONTROLLER or by establishing the desired PAH using the CWS Interrupt switch or Vertical Trim switch.

SECTION 5 - PERFORMANCE

Installation of the King KFC 200 Flight Control System does not affect the basic performance information presented by Section 5 of this handbook.

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SUPPLEMENT 12

KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM (WITH FLIGHT DIRECTOR INSTALLATION)

SECTION 1 - GENERAL

This manual is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System with optional Flight Director as installed in the Aztec. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" as a permanent part of this handbook based on King STC No. SA1163CE and must remain in this handbook at all times when the optional King KFC 200 Automatic Flight Control System is installed.

The KFC 200 is certified in this airplane with two axis control - pitch and roll. The System may be operated as a Flight Director alone with the pilot steering the airplane to the Flight Director command presentation or the autopilot may be engaged to steer the airplane to the Flight Director command presentation.

The airplane is equipped with an electric trim system which is controlled by pilot operation of the trim switch. When autopilot coupled, the autopilot uses the electric trim system to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/electric pitch trim monitor is provided in the autopilot. Autotrim and/or electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

This airplane is equipped with a manual electric pitch trim system designed to withstand any type in-flight single malfunction provided that the system is fully functional during the preflight operational check.

ABBREVIATIONS

ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS (SYNC)	Control Wheel Steering or Synchronization
DISC	Disconnect
FDI	Flight Director Indicator
FCS	Flight Control System
FD	Flight Director System
GA	Go Around
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, pilot must be seated at the controls with seat belt fastened. Operation is restricted to the left-side pilot position.
(b) Maximum speed for autopilot operation is 200 KIAS.
(c) The autopilot must be disengaged during takeoff and landing.
(d) System approved for Category I operation only (APPR or BC selected).
(e) Autopilot attitude command limits:
Pitch ±15°
Roll ±25°
(f) The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight test was 14,000 feet for the non-turbo Aztec and 24,000 feet for the turbocharged Aztec. Operation of the autopilot above 14,000 feet without the installation of a KA 132 Acceleration switch is prohibited.
(g) Placards:
Location - Pilot's control wheel, left horn:

AP DISC   TRIM INTERRUPT

- Pilot's control wheel, left horn:

CWS (SYNC)

- Pilot's control wheel, left horn:

TRIM UP/DN

- Left throttle lever:

GO AROUND

- Directly beneath the KI 525A PNI:

CONDUCT AFCS PREFLIGHT CHECK PRIOR TO FLIGHT IN ACCORDANCE WITH FLIGHT MANUAL.

- Immediately adjacent to the Acceleration Test Switch (Turbo Aztec only):

ACCEL
TEST
UP/DN

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT DISENGAGEMENT
Disengage the Autopilot and/or prevent engagement by:
(1) Pilot's AP DISC switch.
(2) AP engage lever on Mode Controller.
(3) Pulling the AUTOPILOT circuit breaker.
(4) Turning aircraft master switch OFF.
(5) Turning avionics master switch OFF.
(6) Actuating manual electric trim.

(b) AUTOMATIC AUTOPILOT DISENGAGEMENT
Any of the following will cause the autopilot to automatically disengage:
(1) External power failure.
(2) Internal Flight Control System failure.
(3) With KCS 55A system a loss of compass valid (displaying HDG flag) disengages the AP and FD when a mode using heading information is engaged. With HDG flag present, only FD and vertical modes can be selected.
(4) (Turbo Aztec only) In the event of an autopilot malfunction, the KA 132 Acceleration switch will disconnect the autopilot if the established "G" envelope is exceeded.

(c) MANUAL ELECTRIC PITCH TRIM
Manual electric pitch trim can be disengaged by pressing AP DISC/TRIM INTERRUPT switch and holding down until recovery can be made. Then turn off AVIONICS MASTER switch or ELEC TRIM switch, if installed, and manually retrim the airplane using the manual trim control crank. After the airplane is trimmed out, pull the (PITCH TRIM) breaker and turn the AVIONICS MASTER switch back on.

NOTE

UNDER CERTAIN FLIGHT CONDITIONS THE MANUAL PITCH TRIM CRANK MAY NOT PROVIDE OVERRIDE CAPABILITY OVER THE ELECTRIC PITCH TRIM AUTHORITY WITH AUTOPILOT/ELECTRIC TRIM ENGAGED.

(d) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTION

	CONFIGURATION	ALT LOSS	ALT LOSS (Turbo Aztec)
(1)	Cruise, Climb, Descent	300′	450′
(2)	Maneuvering	50′	100′
(3)	APPR	10′	75′
(4)	SE APPR	10′	50′

(e) ENGINE FAILURE (Coupled)
   (1) Disengage AP
   (2) Follow basic Airplane Flight Manual single-engine procedures.
   (3) Airplane rudder and aileron axes must be manually trimmed prior to engaging autopilot for single-engine operations.

CAUTION

IF RUDDER TRIM CANNOT BE MAINTAINED WHEN POWER IS CHANGED DURING A SINGLE-ENGINE COUPLED APPROACH, DISENGAGE AUTOPILOT AND CONTINUE APPROACH MANUALLY.

CAUTION

WHEN THE AUTOPILOT IS ENGAGED, MANUAL APPLICATION OF A FORCE TO THE PITCH AXIS OF THE CONTROL WHEEL FOR A PERIOD OF THREE SECONDS OR MORE WILL RESULT IN THE AUTOTRIM SYSTEM OPERATING IN THE DIRECTION TO CREATE A FORCE OPPOSING THE PILOT. THIS OPPOSING MISTRIM FORCE WILL CONTINUE TO INCREASE AS LONG AS THE PILOT APPLIES A FORCE TO THE CONTROL WHEEL, AND WILL ULTIMATELY OVERPOWER THE AUTOPILOT. IF THE AUTOPILOT IS DISENGAGED UNDER THESE CONDITIONS, THE PILOT MAY BE REQUIRED TO EXERT CONTROL FORCES IN EXCESS OF 50 POUNDS TO MAINTAIN THE DESIRED AIRCRAFT ATTITUDE. THE PILOT WILL HAVE TO MAINTAIN THIS CONTROL FORCE WHILE HE MANUALLY RETRIMS THE AIRCRAFT.

SECTION 4 - NORMAL PROCEDURES

(a) The airplane MASTER SWITCH function is unchanged and can be used in an emergency to shut off all electrical power while the problem is isolated.
(b) The AVIONICS MASTER switch supplies power to the avionics bus bar of the radio circuit breakers, FD/AP and ELEC TRIM circuit breakers.
(c) The ELEC TRIM switch, if installed, controls power to the airplane's manual electric trim system and autopilot autotrim system.
(d) The KFC 200 is controlled by the following circuit breakers:

AUTOPILOT (FD/AP) - This supplies power to the KC 295 Flight Computer, KA 285 Annunciator Panel, KI 256 FDI if used, and AP Pitch and Roll Servos.

AVIONICS MASTER (RADIO MASTER) - This in conjunction with the AVIONICS MASTER switch supplies power to the avionics bus.

COMP. SYSTEM (COMPASS) - This supplies power to the KCS 55/55A Compass System.

PITCH TRIM (ELEC. TRIM) - This supplies power to the FCS autotrim and manual electric pitch trim systems.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP and interrupt the power to the electric trim system and disconnect all FD modes. To resume AP control, a FD Mode and the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed which removes all power from the trim system to allow the pilot time to turn off the AVIONICS MASTER switch and pull the (ELEC TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, or ALT hold mode and will transfer the GA mode to PAH. When the CWS is held depressed, manual electric pitch trim may be operated without disengaging the AP.

TRIM UP/DN - Manual electric pitch trim is activated by a dual-action type switch that requires both parts be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller. (Except when CWS switch is held depressed as previously noted.)

GA - The GA switch is located on the left engine throttle. The operation of the switch will indicate a fixed angle of climb of 6° on the FD. Selection of the GA Mode when in the APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. The AP, however, can be engaged or re-engaged with GA mode selected and will follow the pitch command to climb at the fixed angle.

FLAP OPERATION - Abrupt retraction of full flaps with the autopilot engaged may cause a pronounced momentary change in pitch attitude.

(f) FCS WARNINGS FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

FD - The KI 256 Flight Director Indicator does not have a warning flag. However, the command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

HDG - This warning flag, mounted in the Pictorial Navigation Indicator, will be in view whenever the Directional Gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected, the AP and/or FD is disengaged. Basic FD mode may then be re-engaged along with any vertical mode and the AP re-engaged.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever the following autotrim and/or manual electric pitch trim failures occur: Trim servo motor running without a command is monitored on manual electric and autotrim. The trim servo motor not running when commanded to run and the trim servo motor running in the wrong direction are monitored on autotrim only. The TRIM warning light flashes at least four times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glide Slope valid (GS pointer being in view on PNI) has to be present before GS may couple. If, after GS CPLD, the valid is lost the system will flash the GS Annunciator and revert from GS CPLD back to PAH with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS CPLD.

NAV - The NAV or APPR Modes (ARM OR CPLD) may be selected and will function with or without a NAV warning flag present. The FDI band steering will continue to provide steering information with or without a valid NAV signal.

(g) BEFORE ENGAGING FLIGHT CONTROL SYSTEM
- (1) Verify that all circuit breakers for the system are in.
- (2) Allow sufficient time for the gyros to come up to speed and for the system to warm up (3-4 minutes).

(h) PREFLIGHT CHECK (Must be performed prior to each flight)
- (1) With no modes engaged and power applied to the system, depress the Test Button on the Mode Controller. All annunciators will be illuminated on the annunciator panel, including the three marker lights and the red TRIM failure light will flash. At least four or more flashes must be observed to indicate proper operation of the autotrim/manual electric pitch trim feature and an audible warning should sound.
- (2) Engage the FD. Then engage the AP, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP can be overpowered. Disconnect the AP by depressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.
- (3) Check the operation of the pilot's control wheel switch functions.
- (4) Disengage the AP and, run the following manual electric pitch trim checks.
  - a. Verify that the ELEC TRIM circuit breaker is in.
  - b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run.
    Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.
  - c. Run the trim from full nose up to full nose down. The time required shall be 37 ± 4 seconds.
  - d. Grasping the manual trim crank wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the crank.)
  - e. Press the AP DISC/TRIM INTERRUPT switch down and hold. The manual electric pitch trim will not operate either up or down.
- (5) Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the KC 290 Mode Controller. Hold the control column from moving and observe the autotrim run in the nose up direction after apprximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose down direction after approximately three seconds.
- (6) Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.
- (7) (Turbo Aztec only) Toggle the Accel Test switch to the UP position: the autopilot will disengage. Re-engage the AP and toggle the switch to the DN position; the autopilot will disengage. In both cases, an audible warning will sound when the AP is disengaged.

CAUTION

DISENGAGE THE AP AND CHECK THAT THE AIRPLANE MANUAL PITCH TRIM IS IN THE TAKEOFF POSITION PRIOR TO TAKEOFF.

(i) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Engage the FD mode first, monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15° pitch attitude. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control while retaining his previous modes, except GA, and conveniently resuming that profile at his discretion.

(2) Disengage Procedure:
Check the airplane trim by monitoring the command bars before disengaging the AP. While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC switch, operating the manual electric pitch trim switch, or by disconnecting the AP engage lever on the Mode Controller. The AP light on the annunciator panel will flash at least four times and remain off to indicate that the AP is disengaged. To deactivate the flight director system, depress the FD switch on the Mode Controller or press the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.

(3) Flight Director Mode (FD):
The FD mode must be engaged before the AP can be engaged. The FD mode alone indicates PAH and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD mode switch on the Mode Controller or by selecting any of the other FD modes he wishes to follow. The FD may be disengaged by depressing the FD mode switch on the Mode Controller at any time the AP is not engaged or by pressing the AP DIS/TRIM INTERRUPT switch on the pilot's control wheel with or without the AP engaged. FD mode engagement is displayed on the annunciator.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC290 MODE CONTROLLER PANEL), MAY BE USED TO TRIM THE PITCH ATTITUDE AT A RATE OF ONE DEGREE PER SECOND.

(4) Altitude Hold Mode (ALT):
When the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 feet per minute climb or descent. The ALT will automatically disengage when glideslope couples or the GA switch is depressed. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC 290 MODE CONTROLLER PANEL), MAY BE USED TO CHANGE OR TRIM THE COMMAND ALTITUDE UP OR DOWN AT 500 TO 700 FPM WITHOUT DISENGAGING THE MODE. THE ALTITUDE EXISTING WHEN THE SWITCH IS RELEASED WILL THEN BE HELD.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The airplane will turn to the heading selected and hold. The pilot may then choose any new heading by merely setting the bug on a new heading. The airplane will automatically turn in the direction the heading bug is turned. To disengage the HDG Mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until intercepting the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or FD mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or APPR when in NAV CPLD/ARM.

CAUTION

THE "NAV" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until intercepting the course unless the APPR switch is engaged with the wings level and there is a centered needle on the CDI. Then the mode will go directly to APPR CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the APPR switch on the Mode Controller; by depressing the GA switch on the left engine throttle control; or by engaging HDG or NAV when in APPR CPLD. The annunciator panel indicates the status of the approach mode.

CAUTION

THE "APPR" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE COMMANDS AND/OR CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(8) Back Course Mode (BC):
For BC operation proceed as for normal approach mode, but engage BC after selecting APPR. The BC switch reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR or GA switches, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(10) Go-Around Mode (GA):
The GA mode may be engaged by depressing the GA switch on the left engine throttle. GA will illuminate on the annunciator panel indicating mode status. The GA mode indicates on the FD a fixed pitch up angle that will give the best rate of climb-out. The AP, if engaged, will disengage. GA will cancel all other vertical modes as well as APPR or NAV CPLD.

(j) VOR PROCEDURES
(1) Tune NAV receiver to the appropriate frequency.
(2) Set the desired heading with the HDG bug to intercept the radial and engage HDG and AP.
(3) Select the desired radial and engage NAV. The airplane will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(k) APPROACH PROCEDURES
(1) Tune ILS or VOR.
(2) Set CDI to front course.
(3) Set Heading Bug and engage HDG to intercept beam at any angle up to 90°.
(4) Engage APPR and note APPR ARM on the annunciator panel.
(5) When the airplane approaches the beam; APPR will couple; HDG will decouple; airplane will track LOC or VOR; and CPLD will illuminate on the annunciator panel.
(6) When the glide slope beam is intercepted, the glide slope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. Airplane will now track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.
(7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

OPERATION OF THE MARKER TEST FUNCTION, AFTER APPROACH COUPLED WILL REDUCE THE FLIGHT CONTROL SYSTEM GAINS. IF THIS SHOULD OCCUR, THE APPR MODE SHOULD BE RECYCLED.

(8) Landing or missed approach.
   a. Disengage AP and land.
   b. Go Around is accomplished by depressing GO AROUND switch on left engine throttle and applying full power. The autopilot, if engaged, will disengage and an aural alert will sound. Manually fly the airplane and retrim as required to establish the GA attitude as displayed on the Flight Director. After the GA attitude has been established and the airplane has been retrimmed, the autopilot may be re-engaged. The APPR mode may be used for a straight away missed approach or HDG may be engaged to turn to the missed approach heading.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the MODE CONTROLLER if in ALT hold or by establishing the desired PAH using the CWS Interrupt switch or Vertical Trim switch.

SECTION 5 - PERFORMANCE

Installation of the King KFC 200 Flight Control System does not affect the basic performance information presented by Section 5 of this handbook.

SUPPLEMENT 13

KFC 200 AUTOMATIC FLIGHT CONTROL SYSTEM (WITH FLIGHT DIRECTOR INSTALLATION) SER. NO. 27-8054001 AND UP AND SER. NO. 27-7854084

SECTION 1 - GENERAL

This manual is to acquaint the pilot with the operation of the KFC 200 Automatic Flight Control System with optional Flight Director as installed in the Aztec. The airplane must be operated within the limitations herein specified.

This supplement has been "FAA Approved" as a permanent part of this handbook based on King STC No. SA1163CE and must remain in this handbook at all times when the optional King KFC 200 Automatic Flight Control System is installed.

The KFC 200 is certified in this airplane with two axis control - pitch and roll. The System may be operated as a Flight Director alone with the pilot steering the airplane to the Flight Director command presentation or the autopilot may be engaged to steer the airplane to the Flight Director command presentation.

The airplane is equipped with an electric trim system which is controlled by pilot operation of the trim switch. When autopilot coupled, the autopilot uses the electric trim system to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/electric pitch trim monitor is provided in the autopilot. Autotrim and/or electric pitch trim faults are visually annunciated on the Mode Annunciator and accompanied by an audible warning.

This airplane is equipped with a manual electric pitch trim system designed to withstand any type in-flight single malfunction provided that the system is fully functional during the preflight operational check.

ABBREVIATIONS

ALT	Altitude or Altitude Hold
AP	Autopilot
APPR	Approach
ARM	System Arm for Capture
BC	Back Course
CDI	Course Deviation Indicator or Control
CPLD	Coupled
CWS (SYNC)	Control Wheel Steering or Synchronization
DISC	Disconnect
FDI	Flight Director Indicator
FCS	Flight Control System
FD	Flight Director System
GA	Go Around
GS	Glide Slope
HDG	Heading Select
LOC	Localizer
NAV	Navigation
PAH	Pitch Attitude Hold
PNI	Pictorial Navigation Indicator

SECTION 2 - LIMITATIONS

(a) During autopilot operation, pilot must be seated at the controls with seat belt fastened. Operation is restricted to the left-side pilot position.
(b) Maximum speed for autopilot operation is 200 KIAS. Minimum speed for autopilot operation is 87 KIAS.
(c) The autopilot must be disengaged during takeoff and landing.
(d) System approved for Category I operation only (APPR Mode selected).
(e) Autopilot attitude command limits:

Pitch	±15°
Roll	±25°

(f) The maximum altitude for operation of the autopilot has not been determined. The maximum altitude demonstrated during flight test was 14,000 feet for the non-turbo Aztec and 24,000 feet for the turbocharged Aztec. Operation of the autopilot above 14,000 feet without the installation of a KA 132 Acceleration switch is prohibited.
(g) Placards:
Location - Pilot's control wheel, left horn:

AP DISC   TRIM INTERRUPT

- Pilot's control wheel, left horn:

CWS (SYNC)

- Pilot's control wheel, left horn:

TRIM UP/DN

- Left throttle lever:

GO AROUND

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT DISENGAGEMENT

Disengage the Autopilot and/or prevent engagement by:

(1) Pilot's AP DISC switch.
(2) AP engage lever on Mode Controller.
(3) Pulling the AUTOPILOT circuit breaker.
(4) Turning aircraft master switch OFF.
(5) Turning avionics master switch OFF.
(6) Actuating manual electric trim.

(b) AUTOMATIC AUTOPILOT DISENGAGEMENT

Any of the following will cause the autopilot to automatically disengage:

(1) External power failure.
(2) Internal Flight Control System failure.
(3) With KCS 55A system a loss of compass valid (displaying HDG flag) disengages the AP and FD when a mode using heading information is engaged. With HDG flag present, only FD and vertical modes can be selected.

(c) MANUAL ELECTRIC PITCH TRIM

Manual electric pitch trim can be disengaged by pressing AP DISC/TRIM INTERRUPT switch and holding down until recovery can be made. Then turn off AVIONICS MASTER switch or ELEC TRIM switch, if installed, and manually retrim the airplane using the manual trim control crank. After the airplane is trimmed out, pull the (PITCH TRIM) breaker and turn the AVIONICS MASTER switch back on.

NOTE

UNDER CERTAIN FLIGHT CONDITIONS THE MANUAL PITCH TRIM CRANK MAY NOT PROVIDE OVERRIDE CAPABILITY OVER THE ELECTRIC PITCH TRIM AUTHORITY WITH AUTOPILOT/ELECTRIC TRIM ENGAGED.

(d) MAXIMUM ALTITUDE LOSSES DUE TO AUTOPILOT MALFUNCTION

	CONFIGURATION	ALT LOSS
(1)	Cruise, Climb, Descent	450′
(2)	Maneuvering	100′
(3)	APPR	75′
(4)	SE APPR	75′

(e) ENGINE FAILURE (Coupled)
 (1) Disengage AP
 (2) Follow basic Airplane Flight Manual single-engine procedures.
 (3) Airplane rudder and aileron axes must be manually trimmed prior to engaging autopilot for single-engine operations.

CAUTION

IF RUDDER TRIM CANNOT BE MAINTAINED WHEN POWER IS CHANGED DURING A SINGLE-ENGINE COUPLED APPROACH, DISENGAGE AUTOPILOT AND CONTINUE APPROACH MANUALLY.

CAUTION

WHEN THE AUTOPILOT IS ENGAGED, MANUAL APPLICATION OF A FORCE TO THE PITCH AXIS OF THE CONTROL WHEEL FOR A PERIOD OF THREE SECONDS OR MORE WILL RESULT IN THE AUTOTRIM SYSTEM OPERATING IN THE DIRECTION TO CREATE A FORCE OPPOSING THE PILOT. THIS OPPOSING MISTRIM FORCE WILL CONTINUE TO INCREASE AS LONG AS THE PILOT APPLIES A FORCE TO THE CONTROL WHEEL, AND WILL ULTIMATELY OVERPOWER THE AUTOPILOT. IF THE AUTOPILOT IS DISENGAGED UNDER THESE CONDITIONS, THE PILOT MAY BE REQUIRED TO EXERT CONTROL FORCES IN EXCESS OF 50 POUNDS TO MAINTAIN THE DESIRED AIRCRAFT ATTITUDE. THE PILOT WILL HAVE TO MAINTAIN THIS CONTROL FORCE WHILE HE MANUALLY RETRIMS THE AIRCRAFT.

SECTION 4 - NORMAL PROCEDURES

(a) The airplane MASTER SWITCH function is unchanged and can be used in an emergency to shut off all electrical power while the problem is isolated.
(b) The AVIONICS MASTER switch supplies power to the avionics bus bar of the radio circuit breakers, FD/AP and ELEC TRIM circuit breakers.
(c) The ELEC TRIM switch, if installed, controls power to the airplane's manual electric trim system and autopilot autotrim system.
(d) The KFC 200 is controlled by the following circuit breakers:

AUTOPILOT (FD/AP) - This supplies power to the KC 295 Flight Computer, KA 285 Annunciator Panel, KI 256 FDI and both servos.

AVIONICS MASTER (RADIO MASTER) - This in conjunction with the AVIONICS MASTER switch supplies power to the avionics bus.

COMP. SYSTEM (COMPASS) - This supplies power to the KCS 55A Compass System.

PITCH TRIM (ELEC. TRIM) - This supplies power to the FCS trim and manual electric trim.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP and interrupt the power to the electric trim system and disconnect all FD modes. To resume AP control a FD Mode and the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed which removes all power from the trim system to allow the pilot time to turn off the AVIONICS MASTER or ELEC TRIM switch, if installed and pull the (ELEC TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, or ALT hold mode and will transfer the GA mode to PAH. When the CWS is held depressed, manual electric pitch trim may be operated without disengaging the AP.

TRIM UP/DN - Manual electric pitch trim is activated by a dual-action type switch that requires both parts be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller. (Except when CWS switch is held depressed as previously noted.)

GA - The GA switch is located on the left engine throttle. The operation of the switch will indicate a fixed angle of climb of 6° on the FD. Selection of the GA Mode when in the APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. The AP, however, can be engaged or re-engaged with GA mode selected and will follow the pitch command to climb at the fixed angle.

(f) FCS WARNINGS FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

FD - The KI 256 Flight Director Indicator does not have a warning flag. However, the command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

HDG - This warning flag, mounted in the Pictorial Navigation Indicator, will be in view whenever the Directional Gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected, the AP and/or FD is disengaged. Basic FD mode may then be re-engaged along with any vertical mode and the AP re-engaged.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever the autotrim and/or manual electric pitch trim failures occur: Trim servo motor running without a command is monitored on manual electric and autotrim. The trim servo motor not running when command to run and the trim servo motor running in the wrong direction are monitored on autotrim only. The TRIM warning light flashes at least four times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glideslope valid (GS pointer being in vieww on PNI) has to be present before GS may couple. If, after GS CPLD, the valid is lost the system will flash the GS Annunciator and revert from GS CPLD back to PAH with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS CPLD.

NAV - The NAV or APPR Modes (ARM OR CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.

AP Disconnect Alert - The Autopilot Disconnect Alert will sound an audible warning for approxmiately two seconds whenever the autopilot engage lever on the KC 290 Mode Controller is disengaged.

(g) BEFORE ENGAGING FLIGHT CONTROL SYSTEM

(1) Verify that all circuit breakers for the system are in.
(2) Allow sufficient time for the gyros to come up to the speed and for the system to warm up (3-4 minutes).

(h) PREFLIGHT CHECK

(1) With no modes engaged and power applied to the system, depress the Test Button on the Mode Controller. All annunciators will be illuminated on the annunciator panel, including the three marker lights. The red TRIM failure light will flash and an audible warning sound at least four times to indicate proper operation of the autotrim electric pitch trim feature.
(2) Engage the FD. Then engage the AP. Apply force to the controls to determine if the AP can be over-powered. Disconnect the AP by depressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.
(3) Disengage the AP and run the following manual electric pitch trim checks.
 a. Verify that the ELEC TRIM circuit breaker is in.
 b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run. Solenoid engagement is recognized as an increase in the force required to move the trim crank.
 c. Grasping the manual trim crank wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the crank.)
 d. Press the AP DISC/TRIM INTERUPT switch down and hold. The manual electric pitch trim will not operate either up or down.
(4) Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the KC 290 Mode Controller. Hold the control column from moving and observe the autotrim run in the nose up direction after approximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose down direction after approximately three seconds.
(5) Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rorate counterclockwise.

CAUTION

OPERATION OF THE AUTOPILOT ON THE GROUND MAY CAUSE THE AUTOTRIM TO RUN BECAUSE OF BACK FORCE GENERATED BY ELEVATOR DOWNSPRINGS OR PILOT INDUCED FORCES. THEREFORE, DISENGAGE THE AP AND CHECK THAT THE AIRPLANE MANUAL TRIM IS IN THE TAKEOFF POSITION PRIOR TO TAKEOFF.

(i) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Engage the FD mode first, monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15° pitch attitude. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control while retaining his previous modes, except GA, and conveniently resuming that profile at his discretion.

(2) Disengage Procedure:
Check the airplane trim by monitoring the command bars before disengaging the AP. While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC switch, operating the manual electric pitch trim switch, or by disconnecting the AP engage lever on the Mode Controller. The AP lgiht on the annunciator panel will flash at least four times and remain off to indicate that the AP is disengaged. To deactivate the flight director system, depress the FD switch on the Mode Controller or press the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.

(3) Flight Director Mode (FD):
The FD mode must be engaged before the AP can be engaged. The FD mode alone indicates PAH and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD mode switch on the Mode Controller or by selecting any of the other FD modes he wishes to follow. The FD may be disengaged by depressing the FD mode switch on the Mode Controller at any time the AP is not engaged or by pressing the DISC/TRIM INTERRUPT switch on the pilot's control wheel with or without the AP engaged. FD mode engagement is displayed on the annunciator.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC290 MODE CONTROLLER PANEL), MAY BE USED TO TRIM THE PITCH ATTITUDE AT A RATE OF ONE DEGREE PER SECOND.

(4) Altitude Hold Mode (ALT):
When the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 feet per minute climb or descent. The ALT will automatically disengage when glideslope couples or the GA switch is depressed. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC 290 MODE CONTROLLER PANEL), MAY BE USED TO CHANGE OR TRIM THE COMMAND ALTITUDE UP OR DOWN AT 500 TO 700 FPM WITHOUT DISENGAGING THE MODE. THE ALTITUDE EXISTING WHEN THE SWITCH IS RELEASED WILL THEN BE HELD.

NOTE

ABRUPT RETRACTION OF FLAPS WITH AUTOPILOT ENGAGED AND THE ALT MODE SELECTOR MAY MOMENTARILY CAUSE A PRONOUNCED CHANGE IN PITCH ATTITUDE.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The airplane will turn to the heading selected and hold. The pilot may then choose any new heading by merely setting the bug on a new heading. The airplane will automatically turn in the direction the heading bug is turned. To disengage the HDG Mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until intercepting the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or FD mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or APPR when in NAV CPLD/ARM.

CAUTION

THE "NAV" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until intercepting the course unless the APPR switch is engaged with the wings level and there is a centered needle on the CDI. Then the mode will go directly to APPR CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the APPR switch on the Mode Controller; by depressing the GA switch on the left engine throttle control; or by engaging HDG or NAV when in APPR CPLD. The annunciator panel indicates the status of the approach mode.

CAUTION

THE "APPR" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE COMMANDS AND/OR CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(8) Back Course Mode (BC):
For BC operation proceed as for normal approach mode, but engage BC after selecting APPR. The BC switch reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR or GA switches, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(10) Go-Around Mode (GA):
The GA mode may be engaged by depressing the GA switch on the left engine throttle. GA will illuminate on the annunciator panel indicating mode status. The GA mode indicates on the FD a fixed pitch up angle that will give the best rate of climb-out. The AP, if engaged, will disengage. GA will cancel all other vertical modes as well as APPR or NAV CPLD.

(j) VOR PROCEDURES
(1) Tune NAV receiver to the appropriate frequency.
(2) Set the desired heading with the HDG bug to intercept the radial and engage HDG and AP.
(3) Select the desired radial and engage NAV. The airplane will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(k) APPROACH PROCEDURES
(1) Tune ILS or VOR.
(2) Set CDI to front course.
(3) Set Heading Bus and engage HDG to intercept beam. (Maximum recommended intercept angle is 90°.)
(4) Engage APPR and note APPR ARM on the annunciator panel.
(5) When the airplane approaches the beam; APPR will couple; HDG will decouple; airplane will track LOC or VOR; and CPLD will illuminate on the annunciator panel.
(6) When the glide slope beam is intercepted, the glide slope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. Airplane will now track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.
(7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

OPERATION OF THE MARKER TEST FUNCTION, AFTER APPROACH COUPLED WILL REDUCE THE FLIGHT CONTROL SYSTEM GAINS. IF THIS SHOULD OCCUR, THE APPR MODE SHOULD BE RECYCLED.

(8) Landing or missed approach.
  a. Disengage AP and land.
  b. Go Around is accomplished by depressing GO AROUND switch on left engine throttle and applying full power. The autopilot, if engaged, will disengage and an aural alert will sound. Manually fly the airplane and retrim as required to establish the GA attitude as displayed on the Flight Director. After the GA attitude has been established and the airplane has been retrimmed, the autopilot may be re-engaged. The APPR mode may be used for a straight away missed approach or HDG may be engaged to turn to the missed approach heading.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the MODE CONTROLLER if in ALT hold or by establishing the desired PAH using the CWS Interrupt switch or Vertical Trim switch.

SECTION 5 - PERFORMANCE

Installation of the King KFC 200 Flight Control System does not affect the basic performance information presented by Section 5 of this handbook.

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the

Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System

as installed in

Piper PA-23-250
Make and Model Airplane

Registration Number: N362BP Serial Number: 27-7954048

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 2-NOV-2017

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	03/18/11	All	Complete Supplement	*Robert Grove* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/18/2011*
2	12/18/12		See Revision 3	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/18/2012*
3	03/26/13		See Revision 4	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *04/12/2013*
4	11/24/14	7	Table 1 • Added new functions	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *11/25/2014*
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		16	Section 2.7 • Modified limitation	
		18	Section 2.12 • Added wire obstacles	
		20	Section 2.21 • Modified limitation	
		20 & 21	Section 2.22 & 2.23 • Added limitations	
		26	Section 3.2.10 • Added Flight Stream 210 to procedure	
		27	Section 4.1 • Removed telephone audio deactivation procedure	
		32	Section 7.5 • Added wire obstacles	
		34	Section 7.9 • Added Flight Stream 210	

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		6-8	Section 1.5 • Added definitions	
		9	Section 2.1 • Updated CRG Revisions	
		12	Table 3 • Added Flight Stream 510 line	
		12	Section 2.7 • MMC additions	
		12	Section 2.8 • Added reference to section 2.29	
		18	Section 2.28 • Fixed error	
		18	Sections 2.29-2.31 • New Sections	
		22	Section 3.2.8 • Reworded and added additional text	
		23	Sections 3.2.9-3.2.13 • New Sections • Renumbered sections	
		27	Section 4.7 • New section	
		29	Section 7.1 • New revision numbers	

LOG OF REVISIONS				
Revision Number	Date	Page Number	Description	FAA Approved
		32	Section 7.9 • Added Flight Stream 510	
		33	Section 7.10 • Reworded	
		34	Table 4 • Added PTC	
		38	Section 7.19 • Flight Stream 510 content added	
		41-42	Sections 7.25-7.26 • New sections	
7	10/17/17	6-8	Sections 1.5 • New definitions	See Page i
		9	Section 2.1 • Updated CRG Revisions	
		10	Section 2.4 • Updated FDE compliance text	
		12	Section 2.6 • Updated software grid	
		13	Section 2.10 • Renamed section	
		19-20	Section 2.32-2.33 • New sections	
		22	Section 3.2.1-2 • Updated text	
		32	Section 7.27 • Updated PG Revisions	
		45	Section 7.27 • New section	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

	GTN 625	GTN 635	GTN 650	GTN 725	GTN 750
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 350 audio panel.

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

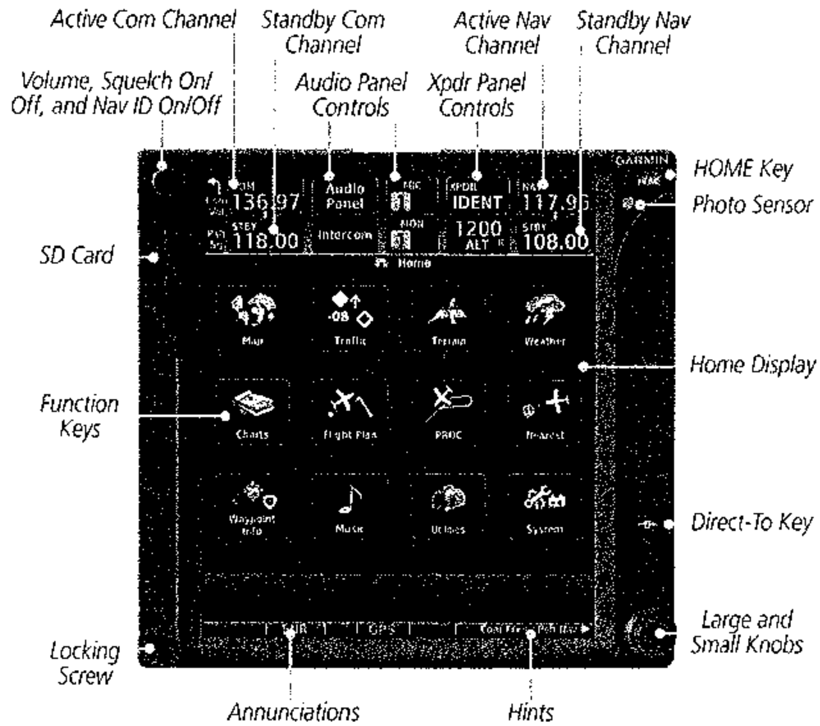

Figure 1 - GTN 750 Control and Display Layout

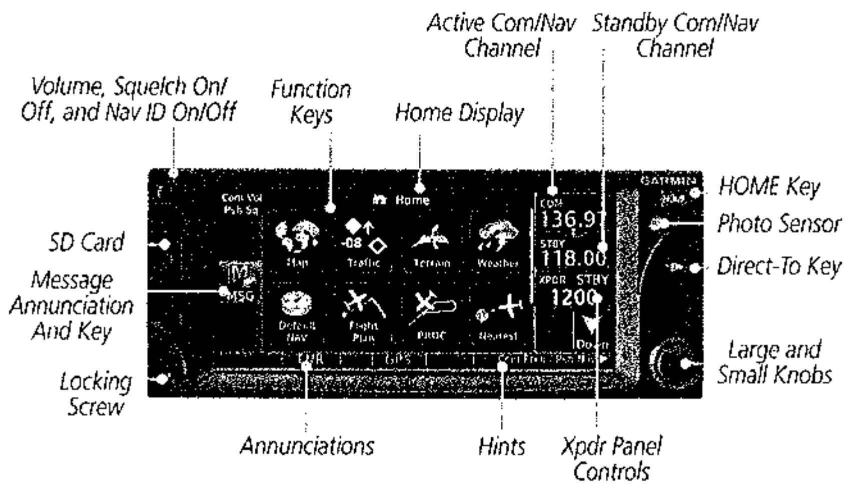

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN specific to the aircraft for which this manual is created.

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☐ VHF Communication Radio
- ☐ Primary VHF Navigation
- ☐ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☐ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status."

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities
The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	GTN Capability
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.4 Electronic Checklists

The GTN checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.5 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
ECAC:	European Civil Aviation Conference
EFB:	Electronic Flight Bag
EGNOS:	European Geostationary Navigation Overlay Service
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GAGAN:	GPS Aided GEO Augmented Navigation
GNSS:	Global Navigation Satellite System
GPA:	Glidepath Angle
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
HOT:	Hazardous Obstacle Transmission wires
HSI:	Horizontal Situation Indicator
IAP:	Instrument Approach Procedure
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System

IMC:	Instrument Meteorological Conditions
LDA:	Localizer Directional Aid
LNAV:	Lateral Navigation
LNAV +V:	Lateral Navigation with advisory Vertical Guidance
L/VNAV:	Lateral/Vertical Navigation
LOC:	Localizer
LOC-BC:	Localizer Backcourse
LP:	Localizer Performance
LPV:	Localizer Performance with Vertical Guidance
LP +V:	Localizer Performance with Advisory Vertical Guidance
MLS:	Microwave Landing System
MMC:	Multi-Media Card
NOTAM:	Notice to Airmen
OBS:	Omni Bearing Selector
PED:	Portable Electronic Device
RAIM:	Receiver Autonomous Integrity Monitoring
RF Leg:	Radius-To-Fix Leg of a Charted Instrument Procedure
RMT:	Remote
RNAV:	Area Navigation
RNP:	Required Navigational Performance
SAR:	Search and Rescue
SBAS:	Satellite Based Augmentation System
SD:	Secure Digital
SDF:	Simplified Directional Facility
SUSP:	Suspend
TACAN:	Tactical Air Navigation System
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System
TCAS:	Traffic Collision Avoidance System
TCH:	Threshold Crossing Height
TFR:	Temporary Flight Restriction
TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VGSI:	Visual Glide-Slope Indicator
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions

VOR:	VHF Omnidirectional Range
VRP:	Visual Reporting Point
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev L
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev K

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138 and FAA AC 90-105A for prediction.

The following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
Garmin WFDE Prediction program	PC-based program included in GTN trainer v3.00 – 6.30. Instructions provided via Garmin part number 190-00643-01	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGER GPS RAIM Prediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	6.41
GPS SW Version	5.2
Com SW Version	2.20
Nav SW Version	6.03
Flight Stream 210	2.70
Flight Stream 510	2.30

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Instrument Approaches

a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V or LP +V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.
f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 Barometric Setting

The barometric altimeter setting used for any barometric corrected altitude source interfaced to the GTN must be set appropriate to the altitude type depicted on the procedure (QNH or QFE).

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- RF legs are limited to RNP 1 procedures. RNP AR and RNP <1 are not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Proximity Function (All Units)

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

Use of the GTN for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

2.18 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a "FT" label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an "ALT IN FT" notification.

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

2.22 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations.

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database

Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates

Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

2.32 OBS Mode

Use of OBS mode for flight plan segments greater than 250NM is prohibited.

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* Includes GMA 35 and GMA 35c Audio Panels

2.33 Advisory Visual Approaches

All advisory visual approaches shall be conducted in VMC. Advisory visual approaches are intended to be used as an aid to situational awareness and do not guarantee terrain or obstruction clearance along the approach path. Use of advisory visual approaches in IMC is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":

Autopilot .... **DISCONNECT**
Aircraft Controls .... **INITIATE MAXIMUM POWER CLIMB**
Airspeed .... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Altitude .... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" and/or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If LOI occurs while the GTN is in the ENR or OCN phase of flight, it may also display DR.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation .... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .... **USE GTN**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GTN):

Navigation .... **FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation to LNAV. The approach may be continued using the LNAV only minimums. If the VISUAL approach is downgraded, the GTN will remove the vertical deviation indication from the VDI, but continue to annunciate VISUAL in amber.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications .... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed)....... **PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)†

Audio Panel Circuit Breaker .... **PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

† Includes GMA 35 and GMA 35c Audio Panels

3.2.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Cockpit Reference Guide for additional information.

To Inhibit TAWS:

Home Hardkey.. **PRESS**
Terrain Button... **PRESS**
Menu Button.. **PRESS**
TAWS Inhibit Button ....**PRESS TO ACTIVATE**

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display will be removed. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN:

To Disable ASR:

Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN becomes unusable due to uncommanded page changes, the ASR function may be the source.

To Disable ASR:

Audio Panel Circuit Breaker .... **PULL**
Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**
Audio Panel Circuit Breaker .... **PUSH**

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a barometric corrected altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN is restarted. This will ensure restoration of the navigation functions as soon as possible.

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases .... **REVIEW DATES**
Self-Test .... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator:
- PULL UP .... **ILLUMINATED**
- TERR .... **ILLUMINATED**
- TERR N/A .... **ILLUMINATED**
- TERR INHB .... **ILLUMINATED**

Self-Test - GPS Remote Annunciator:
- VLOC .... **ILLUMINATED**
- GPS .... **ILLUMINATED**
- LOI or INTG .... **ILLUMINATED**
- TERM .... **ILLUMINATED**
- WPT .... **ILLUMINATED**
- APR .... **ILLUMINATED**
- MSG .... **ILLUMINATED**
- SUSP or OBS .... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators .... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

The GTN does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

☐ This installation *has* a heading source. The GTN will provide roll steering on heading legs for the autopilot.

☑ This installation *does not have* a heading source. The crew cannot use the GTN roll steering to fly heading legs with the autopilot.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

☑ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button .... **PRESS**
"Enable APR Output" Button .... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot.. **ENGAGE APPROACH MODE**

☑ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance ....**CONFIRM AVAILABLE**
Autopilot.. **ENGAGE APPROACH MODE**

☐ The installation *does not* support any vertical capture or vertical tracking.

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

☑ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.

☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.

☐ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.7 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to install the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately available to the flight crew.

- GTN 6XX Pilot's Guide — P/N 190-01004-03 Rev L or later
- GTN 7XX Pilot's Guide — P/N 190-01007-03 Rev N or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

☐ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☑ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☑ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts, if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

The area of coverage may be modified as additional terrain data sources become available.

- ☑ This installation supports *Terrain Proximity. No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.
- ☐ This installation supports *TAWS B.* Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted, or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

(e) PILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC/TRIM INTERRUPT - This emergency disconnect switch will disengage the AP and interrupt the power to the electric trim system and disconnect all FD modes. To resume AP control a FD Mode and the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held depressed which removes all power from the trim system to allow the pilot time to turn off the AVIONICS MASTER or ELEC TRIM switch, if installed and pull the (ELEC TRIM) circuit breaker.

CWS - This switch when depressed and held will allow the pilot to manually fly the airplane without disengaging the AP. When the switch is released the AP will resume control, (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, or ALT hold mode and will transfer the GA mode to PAH. When the CWS is held depressed, manual electric pitch trim may be operated without disengaging the AP.

TRIM UP/DN - Manual electric pitch trim is activated by a dual-action type switch that requires both parts be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller. (Except when CWS switch is held depressed as previously noted.)

GA - The GA switch is located on the left engine throttle. The operation of the switch will indicate a fixed angle of climb of 6° on the FD. Selection of the GA Mode when in the APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. The AP, however, can be engaged or re-engaged with GA mode selected and will follow the pitch command to climb at the fixed angle.

(f) FCS WARNINGS FLAGS AND ANNUNCIATORS DESIGNATION AND OPERATION

FD - The KI 256 Flight Director Indicator does not have a warning flag. However, the command bars will be biased out of view whenever the system is invalid or a FD mode is not engaged.

HDG - This warning flag, mounted in the Pictorial Navigation Indicator, will be in view whenever the Directional Gyro information is invalid. If a HDG invalid occurs with either NAV, APPR, or HDG modes selected, the AP and/or FD is disengaged. Basic FD mode may then be re-engaged along with any vertical mode and the AP re-engaged.

TRIM - The TRIM warning light, located in the lower right corner of the annunciator panel, will flash and be accompanied by an audible warning whenever the autotrim and/or manual electric pitch trim failures occur: Trim servo motor running without a command is monitored on manual electric and autotrim. The trim servo motor not running when command to run and the trim servo motor running in the wrong direction are monitored on autotrim only. The TRIM warning light flashes at least four times and the audible warning sounds when the test switch on the Mode Controller is depressed.

GS - The Glideslope valid (GS pointer being in vieww on PNI) has to be present before GS may couple. If, after GS CPLD, the valid is lost the system will flash the GS Annunciator and revert from GS CPLD back to PAH with the FDI pitch steering bar providing pitch attitude steering information. If the GS valid returns the system will revert back to GS CPLD.

NAV - The NAV or APPR Modes (ARM OR CPLD) may be selected and will function with or without a NAV warning flag present. The FDI bank steering will continue to provide steering information with or without a valid NAV signal.

AP Disconnect Alert - The Autopilot Disconnect Alert will sound an audible warning for approxmiately two seconds whenever the autopilot engage lever on the KC 290 Mode Controller is disengaged.

(g) BEFORE ENGAGING FLIGHT CONTROL SYSTEM

(1) Verify that all circuit breakers for the system are in.
(2) Allow sufficient time for the gyros to come up to the speed and for the system to warm up (3-4 minutes).

(h) PREFLIGHT CHECK

(1) With no modes engaged and power applied to the system, depress the Test Button on the Mode Controller. All annunciators will be illuminated on the annunciator panel, including the three marker lights. The red TRIM failure light will flash and an audible warning sound at least four times to indicate proper operation of the autotrim electric pitch trim feature.
(2) Engage the FD. Then engage the AP. Apply force to the controls to determine if the AP can be over-powered. Disconnect the AP by depressing the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.
(3) Disengage the AP and run the following manual electric pitch trim checks.
    a. Verify that the ELEC TRIM circuit breaker is in.
    b. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run. Solenoid engagement is recognized as an increase in the force required to move the trim crank.
    c. Grasping the manual trim crank wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the crank.)
    d. Press the AP DISC/TRIM INTERUPT switch down and hold. The manual electric pitch trim will not operate either up or down.
(4) Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the KC 290 Mode Controller. Hold the control column from moving and observe the autotrim run in the nose up direction after approximately three seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose down direction after approximately three seconds.
(5) Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rorate counterclockwise.

CAUTION

OPERATION OF THE AUTOPILOT ON THE GROUND MAY CAUSE THE AUTOTRIM TO RUN BECAUSE OF BACK FORCE GENERATED BY ELEVATOR DOWNSPRINGS OR PILOT INDUCED FORCES. THEREFORE, DISENGAGE THE AP AND CHECK THAT THE AIRPLANE MANUAL TRIM IS IN THE TAKEOFF POSITION PRIOR TO TAKEOFF.

(i) IN-FLIGHT OPERATION

(1) Engage Procedure:
After takeoff, clean up airplane and establish climb. Engage the FD mode first, monitor flight controls and engage AP. The pitch attitude will lock on any attitude up to 15° pitch attitude. Engaging and holding the CWS switch allows the pilot to momentarily revert to manual control while retaining his previous modes, except GA, and conveniently resuming that profile at his discretion.

(2) Disengage Procedure:
Check the airplane trim by monitoring the command bars before disengaging the AP. While monitoring the flight controls, disengage the system by one of the following methods: depressing the pilot's AP DISC switch, operating the manual electric pitch trim switch, or by disconnecting the AP engage lever on the Mode Controller. The AP lgiht on the annunciator panel will flash at least four times and remain off to indicate that the AP is disengaged. To deactivate the flight director system, depress the FD switch on the Mode Controller or press the AP DISC/TRIM INTERRUPT switch on the pilot's control wheel.

(3) Flight Director Mode (FD):
The FD mode must be engaged before the AP can be engaged. The FD mode alone indicates PAH and wings level. The pilot may choose to fly the FDI commands manually, without the AP engaged, by depressing the FD mode switch on the Mode Controller or by selecting any of the other FD modes he wishes to follow. The FD may be disengaged by depressing the FD mode switch on the Mode Controller at any time the AP is not engaged or by pressing the DISC/TRIM INTERRUPT switch on the pilot's control wheel with or without the AP engaged. FD mode engagement is displayed on the annunciator.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC290 MODE CONTROLLER PANEL), MAY BE USED TO TRIM THE PITCH ATTITUDE AT A RATE OF ONE DEGREE PER SECOND.

(4) Altitude Hold Mode (ALT):
When the ALT switch on the Mode Controller is pressed, the airplane will maintain the pressure altitude existing at the time the switch is depressed. For smooth operation, engage the ALT at no greater than 500 feet per minute climb or descent. The ALT will automatically disengage when glideslope couples or the GA switch is depressed. ALT hold may be turned off at any time by depressing the ALT switch. ALT engagement is displayed on the annunciator panel.

NOTE

THE "VERTICAL TRIM" SWITCH, (LOCATED ON THE KC 290 MODE CONTROLLER PANEL), MAY BE USED TO CHANGE OR TRIM THE COMMAND ALTITUDE UP OR DOWN AT 500 TO 700 FPM WITHOUT DISENGAGING THE MODE. THE ALTITUDE EXISTING WHEN THE SWITCH IS RELEASED WILL THEN BE HELD.

NOTE

ABRUPT RETRACTION OF FLAPS WITH AUTOPILOT ENGAGED AND THE ALT MODE SELECTOR MAY MOMENTARILY CAUSE A PRONOUNCED CHANGE IN PITCH ATTITUDE.

(5) Heading Mode (HDG):
Set the heading bug to the desired heading on the PNI, depress the HDG switch on the Mode Controller and HDG will be displayed on the annunciator panel. The airplane will turn to the heading selected and hold. The pilot may then choose any new heading by merely setting the bug on a new heading. The airplane will automatically turn in the direction the heading bug is turned. To disengage the HDG Mode, depress the HDG switch on the Mode Controller and observe the HDG light go out on the annunciator. The HDG mode will automatically disengage when APPR or NAV CPLD is achieved.

(6) Navigation Mode (NAV):
The Navigation mode may be selected by tuning the NAV receiver to the desired frequency, setting the CDI to the desired radial and depressing the NAV switch on the Mode Controller. The annunciator will indicate NAV ARM until intercepting the selected course, unless the NAV switch is engaged with wings level and a centered needle on the CDI. Then the mode will go directly to NAV CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. If a condition requiring a capture exists at mode engagement, the pilot is required to set up an intercept angle using either HDG or FD mode. NAV may be disengaged by depressing the NAV switch or by engaging HDG when in NAV CPLD or APPR when in NAV CPLD/ARM.

CAUTION

THE "NAV" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE CONTROL WITHOUT A VALID VOR/ LOC SIGNAL (NAV FLAG IN VIEW).

(7) Approach Mode (APPR):
The Approach mode may be selected by tuning the NAV receiver to the desired VOR or LOC frequency, setting the CDI to the desired radial or inbound heading and depressing the APPR switch on the Mode Controller. The annunciator will indicate APPR ARM until intercepting the course unless the APPR switch is engaged with the wings level and there is a centered needle on the CDI. Then the mode will go directly to APPR CPLD as displayed on the annunciator panel. The system can intercept at any angle up to 90° and will always turn toward the course pointer. See approach procedure for more detail. APPR mode can be disengaged by depressing the APPR switch on the Mode Controller; by depressing the GA switch on the left engine throttle control; or by engaging HDG or NAV when in APPR CPLD. The annunciator panel indicates the status of the approach mode.

CAUTION

THE "APPR" MODE OF OPERATION WILL CONTINUE TO PROVIDE AIRPLANE COMMANDS AND/OR CONTROL WITHOUT A VALID VOR/LOC SIGNAL (NAV FLAG IN VIEW).

(8) Back Course Mode (BC):
For BC operation proceed as for normal approach mode, but engage BC after selecting APPR. The BC switch reverses the signals in the computer and cannot be engaged without a LOC frequency selected. BC status is indicated on the annunciator panel. BC mode can be disengaged by depressing either the BC, APPR or GA switches, or by selecting other than a LOC frequency on the NAV receiver.

(9) Vertical Mode Switch (Trim Up/Dn):
Operation of the vertical trim switch on the Mode Controller provides a convenient means of adjusting the ALT hold or PAH angle function without disengaging the mode.

(10) Go-Around Mode (GA):
The GA mode may be engaged by depressing the GA switch on the left engine throttle. GA will illuminate on the annunciator panel indicating mode status. The GA mode indicates on the FD a fixed pitch up angle that will give the best rate of climb-out. The AP, if engaged, will disengage. GA will cancel all other vertical modes as well as APPR or NAV CPLD.

(j) VOR PROCEDURES
(1) Tune NAV receiver to the appropriate frequency.
(2) Set the desired heading with the HDG bug to intercept the radial and engage HDG and AP.
(3) Select the desired radial and engage NAV. The airplane will remain on HDG as indicated on the annunciator panel and in ARM on the NAV mode. When the airplane intercepts the beam, the system will automatically couple and track in NAV mode and indicate CPLD on the annunciator panel.
(4) A new course may be selected over the VOR station when operating in the NAV mode, by selecting a new radial when the To-From indication changes.
(5) For VOR approach, see approach procedure.

(k) APPROACH PROCEDURES
(1) Tune ILS or VOR.
(2) Set CDI to front course.
(3) Set Heading Bus and engage HDG to intercept beam. (Maximum recommended intercept angle is 90°.)
(4) Engage APPR and note APPR ARM on the annunciator panel.
(5) When the airplane approaches the beam; APPR will couple; HDG will decouple; airplane will track LOC or VOR; and CPLD will illuminate on the annunciator panel.
(6) When the glide slope beam is intercepted, the glide slope will couple automatically and indicate GS on the annunciator panel. If ALT was engaged prior to intercepting the glide slope, it will automatically disengage when GS couples. Airplane will now track LOC and GS. Adjust throttles to control speed on descent. Set HDG bug for missed approach but do not engage HDG.
(7) When middle marker signal is received, system will automatically switch to a more stable track mode.

NOTE

OPERATION OF THE MARKER TEST FUNCTION, AFTER APPROACH COUPLED WILL REDUCE THE FLIGHT CONTROL SYSTEM GAINS. IF THIS SHOULD OCCUR, THE APPR MODE SHOULD BE RECYCLED.

(8) Landing or missed approach.
   a. Disengage AP and land.
   b. Go Around is accomplished by depressing GO AROUND switch on left engine throttle and applying full power. The autopilot, if engaged, will disengage and an aural alert will sound. Manually fly the airplane and retrim as required to establish the GA attitude as displayed on the Flight Director. After the GA attitude has been established and the airplane has been retrimmed, the autopilot may be re-engaged. The APPR mode may be used for a straight away missed approach or HDG may be engaged to turn to the missed approach heading.

(l) BACK COURSE PROCEDURE
Same as front course except that BC is engaged after APPR is engaged and the airplane must be set for descent manually by holding the vertical trim switch DN on the MODE CONTROLLER if in ALT hold or by establishing the desired PAH using the CWS Interrupt switch or Vertical Trim switch.

SECTION 5 - PERFORMANCE

Installation of the King KFC 200 Flight Control System does not affect the basic performance information presented by Section 5 of this handbook.

Garmin International, Inc.
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Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System
as installed in

Piper PA-23-250
Make and Model Airplane

Registration Number: N3628P Serial Number: 27-7954048

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved by: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 2-NOV-2017

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	03/18/11	All	Complete Supplement	*Robert Grove* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *03/18/2011*
2	12/18/12		See Revision 3	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *12/18/2012*
3	03/26/13		See Revision 4	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: *04/12/2013*
4	11/24/14	7	Table 1 • Added new functions	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *11/25/2014*
		11	Section 1.4 • New section	
		16	Section 2.7 • Modified limitation	
		18	Section 2.12 • Added wire obstacles	
		20	Section 2.21 • Modified limitation	
		20 & 21	Section 2.22 & 2.23 • Added limitations	
		26	Section 3.2.10 • Added Flight Stream 210 to procedure	
		27	Section 4.1 • Removed telephone audio deactivation procedure	
		32	Section 7.5 • Added wire obstacles	
		34	Section 7.9 • Added Flight Stream 210	

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	Page			
Revision Number	Date	Number	Description	FAA Approved
		34 37	Section 7.10 • Added wire obstacles Section 7.17 • Added section	
5	02/25/16	All	All Sections • Reformatted and updated sections to better coincide with the VFR AFMS. Section 2 • Added RF leg description and limitations • Added QFE limitations • Added Autopilot limitations • Added polar operation limitation • Added text regarding new data units in the GTN • Added Fuel Range Ring description and limitations • Added Flight Stream 210 limitation Section 4 • Added autopilot capability assessment regarding RF legs • Updated installer descriptions of configuration checkboxes • Added Search and Rescue autopilot note • Added RNP 1.0 installation options Section 7 • Added GMA 35c information • Removed references to GDL 88 and replaced with generic ADS-B	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *02/25/2016*

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			• Added GWX 70 turbulence detection note • Added GTN crossfill information	
6	09/09/16	1	Table 1 • Added Flight Stream 510 data	*Michael Warren* ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date : *09/09/2016*
		5	Section 1.2 • Removed text	
		6-8	Section 1.5 • Added definitions	
		9	Section 2.1 • Updated CRG Revisions	
		12	Table 3 • Added Flight Stream 510 line	
		12	Section 2.7 • MMC additions	
		12	Section 2.8 • Added reference to section 2.29	
		18	Section 2.28 • Fixed error	
		18	Sections 2.29-2.31 • New Sections	
		22	Section 3.2.8 • Reworded and added additional text	
		23	Sections 3.2.9-3.2.13 • New Sections • Renumbered sections	
		27	Section 4.7 • New section	
		29	Section 7.1 • New revision numbers	

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Revision Number	Date	Number	Description	FAA Approved
		32	<u>Section 7.9</u> • Added Flight Stream 510	
		33	<u>Section 7.10</u> • Reworded	
		34	<u>Table 4</u> • Added PTC	
		38	<u>Section 7.19</u> • Flight Stream 510 content added	
		41-42	<u>Sections 7.25-7.26</u> • New sections	
7	10/17/17	6-8	<u>Sections 1.5</u> • New definitions	See Page i
		9	<u>Section 2.1</u> • Updated CRG Revisions	
		10	<u>Section 2.4</u> • Updated FDE compliance text	
		12	<u>Section 2.6</u> • Updated software grid	
		13	<u>Section 2.10</u> • Renamed section	
		19-20	<u>Section 2.32-2.33</u> • New sections	
		22	<u>Section 3.2.1-2</u> • Updated text	
		32	<u>Section 7.27</u> • Updated PG Revisions	
		45	<u>Section 7.27</u> • New section	

Table of Contents

Section 1. General

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

	GTN 625	GTN 635	GTN 650	GTN 725	GTN 750
GPS SBAS Navigation: • Oceanic, enroute, terminal, and non-precision approach guidance • Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connext (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)	X*	X*	X*	X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151c Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X
Control of Flight Stream 210 (optional)	X	X	X	X	X
Control of Flight Stream 510 (optional)	X	X	X	X	X

* Display of marker beacon annunciations on the GTN 6XX is only possible when installed with a Garmin GMA 350 audio panel.

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

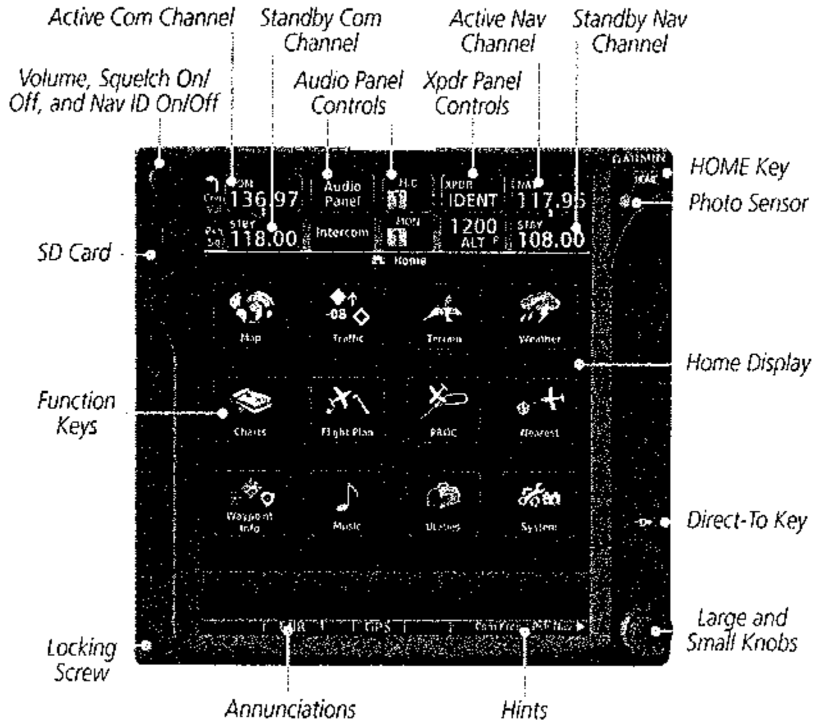

Figure 1 - GTN 750 Control and Display Layout

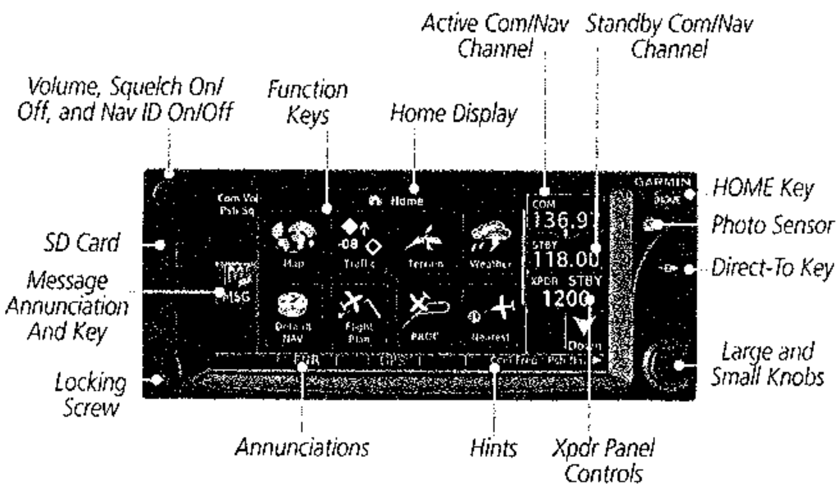

Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

This Flight Manual Supplement documents the installed capabilities of the GTN specific to the aircraft for which this manual is created.

NOTE

In sections which contain a square checkbox (□) the installer will have placed an "X" in the boxes next to the capabilities applicable to the installation.

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☐ VHF Communication Radio
- ☐ Primary VHF Navigation
- ☐ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☐ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151c Terrain Awareness and Warning System – See section 2.15

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR enroute, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV".

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures including procedures with RF legs subject to the limitations herein. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system consists of one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status."

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Advanced RNP Capabilities
The GTN includes 3 out of 6 of the features required for operations in airspace requiring Advance RNP based on the *ICAO document 9613 Performance Based Navigation (PBN) Manual, fourth edition, 2013* and is therefore not approved for Advanced RNP operations. The following table describes the six Advanced RNP capabilities and the GTN capabilities.

Advanced RNP Feature	**GTN Capability**
RF legs	Available if enabled for installation. See Section 2.12 for limitations.
Parallel offsets	Available.
Scalable RNP	GTN provides CDI scalability in compliance with TSO-C146c. RNP scalability is not available.
RNAV holding	Available.
Fixed radius transitions	Not available in GTN.
Time of arrival control (TOAC)	Not available in GTN.

1.3 Electronic Flight Bag

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

Use of the Flight Stream interface and data for the purpose of Electronic Flight Bag applications is not approved as part of this STC. Additional approval may be required to obtain operational approval for use of the Flight Stream and supplied data to supplement EFB systems.

1.4 Electronic Checklists

The GTN checklist functions are designed to DO-178B software design assurance level B and support a minor failure classification. While this STC does not grant operational approval for operators requiring such approval, there are no limitations precluding operators from obtaining their own operational approval for the checklist function.

1.5 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
ECAC:	European Civil Aviation Conference
EFB:	Electronic Flight Bag
EGNOS:	European Geostationary Navigation Overlay Service
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GAGAN:	GPS Aided GEO Augmented Navigation
GNSS:	Global Navigation Satellite System
GPA:	Glidepath Angle
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
HOT:	Hazardous Obstacle Transmission wires
HSI:	Horizontal Situation Indicator
IAP:	Instrument Approach Procedure
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System

IMC: Instrument Meteorological Conditions
LDA: Localizer Directional Aid
LNAV: Lateral Navigation
LNAV +V: Lateral Navigation with advisory Vertical Guidance
L/VNAV: Lateral/Vertical Navigation
LOC: Localizer
LOC-BC: Localizer Backcourse
LP: Localizer Performance
LPV: Localizer Performance with Vertical Guidance
LP +V: Localizer Performance with Advisory Vertical Guidance
MLS: Microwave Landing System
MMC: Multi-Media Card
NOTAM: Notice to Airmen
OBS: Omni Bearing Selector
PED: Portable Electronic Device
RAIM: Receiver Autonomous Integrity Monitoring
RF Leg: Radius-To-Fix Leg of a Charted Instrument Procedure
RMT: Remote
RNAV: Area Navigation
RNP: Required Navigational Performance
SAR: Search and Rescue
SBAS: Satellite Based Augmentation System
SD: Secure Digital
SDF: Simplified Directional Facility
SUSP: Suspend
TACAN: Tactical Air Navigation System
TAS: Traffic Awareness System
TAWS: Terrain Awareness and Warning System
TCAS: Traffic Collision Avoidance System
TCH: Threshold Crossing Height
TFR: Temporary Flight Restriction
TIS: Traffic Information Service
VHF: Very High Frequency
VFR: Visual Flight Rules
VGSI: Visual Glide-Slope Indicator
VLOC: VOR/Localizer
VMC: Visual Meteorological Conditions

VOR:	VHF Omnidirectional Range
VRP:	Visual Reporting Point
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev L
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev K

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs. maximum takeoff weight:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:
Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability. An acceptable means of compliance for FDE prediction programs is to use a certified service which meets the requirements of FAA AC 20-138 and FAA AC 90-105A for prediction.

The following table describes some of the available RAIM prediction programs.

Prediction Program	Internet address or program details	Coverage Area
Garmin RAIM Prediction Tool	https://fly.garmin.com/fly-garmin/support/raim/	Worldwide
Garmin WFDE Prediction program	PC-based program included in GTN trainer v3.00 – 6.30. Instructions provided via Garmin part number 190-00643-01	Worldwide
FAA Service Availability Prediction Tool	http://sapt.faa.gov	US Only
Flight Service Station	1-800-WXBRIEF https://www.1800wxbrief.com	US Only
AUGER GPS RAIM Prediction Tool	http://augur.ecacnav.com/augur/app/home	ECAC Airspace Only

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status or Connext Setup pages.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
Main SW Version	6.41
GPS SW Version	5.2
Com SW Version	2.20
Nav SW Version	6.03
Flight Stream 210	2.70
Flight Stream 510	2.30

Table 3 - Software Versions

2.7 MMC / SD Database Cards

It is required that the SD database card or Flight Stream 510 (MMC) be present in the GTN at all times. The SD or MMC device must not be removed or inserted during flight or while the GTN is powered on.

NOTE

Removal of the SD or MMC device will result in certain features and databases not being available and may slow system performance.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

See Section 2.29 for limitations regarding database update procedures.

2.9 Ground Operations

Do not use SafeTaxi or ChartView functions as the basis for ground maneuvering. SafeTaxi and ChartView functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and ChartView are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Instrument Approaches

a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV +V, L/VNAV, LPV, LP, or LP +V)
b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V or LP +V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Pilots are prohibited from flying any approach path that contains manually entered waypoints.
f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 Barometric Setting

The barometric altimeter setting used for any barometric corrected altitude source interfaced to the GTN must be set appropriate to the altitude type depicted on the procedure (QNH or QFE).

2.12 RF Legs

This STC does not grant operational approval for RF leg navigation for those operators requiring operational approval. Additional FAA approval may be required for those aircraft intending to use the GTN as a means to provide RNP 1 navigation in accordance with FAA Advisory Circular AC 90-105.

The following limitations apply to procedures with RF legs:

- Aircraft is limited to 180 KIAS while on the RF leg
- RF legs are limited to RNP 1 procedures. RNP AR and RNP <1 are not approved
- Primary navigation guidance on RF legs must be shown on an EHSI indicator with auto-slew capability turned ON
- GTN Moving Map, EHSI Map, or Distance to Next Waypoint information must be displayed to the pilot during the RF leg when flying without the aid of the autopilot or flight director.
- The active waypoint must be displayed in the pilot's primary field of view.

2.13 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

It is possible to create flight plan waypoint sequences, including Search and Rescue patterns, which exceed the autopilot's bank angle capabilities. The pilot shall monitor autopilot performance with regard to flight path deviation.

2.13.1 RNP 1.0 RF Leg Types

AC 90-105 states that procedures with RF legs must be flown using either a flight director or coupled to the autopilot.

This STC has demonstrated acceptable crew workload and Flight Technical Error for hand flown procedures with RF legs when the GTN installation complies with limitation set forth in Section 2.12 of this document. It is recommended to couple the autopilot for RF procedures, if available, but it is not required to do so. See section 4.5 of this manual to determine if this capability is supported in this installation.

2.14 Terrain Proximity Function (All Units)

Terrain, point obstacle, and wire obstacle information appears on the map and terrain display pages as red and amber terrain, obstacles, or wires and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain, obstacle and wire information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.15 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

TAWS shall be inhibited when landing at an airport that is not included in the airport database.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

> Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.16 Polar Operations

Use of the GTN for primary navigation for latitudes above 89.00° N and below 89.00° S is prohibited.

2.17 Datalink Weather Display (Optional)

This limitation applies to datalink weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88 or GTX 345, and Connext via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

Datalink text weather is decoded for the convenience of the pilot, however it is possible that the decoding may be affected by anomalies in the data or differences in the units of measure between the decoding system and the text weather source. All text weather displayed on the GTN also includes the raw weather text for pilot review.

2.18 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

Traffic is displayed in feet regardless of the unit settings for altitude. If the units for altitude are different than feet, a "FT" label will appear on the traffic icon on and main map page, and the dedicated traffic page will include an "ALT IN FT" notification.

2.19 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

2.20 Flight Planner/Calculator Functions

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination.

2.21 Fuel Range Rings

The fuel range rings displayed on the moving map are intended for situational awareness and do not represent a direct indication of endurance or fuel remaining. The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes by default. The reserve value can be changed from the GTN map setup menu.

Fuel range data is derived by the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

2.22 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combinations.

2.23 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.24 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.25 Telephone Audio

Telephone audio must not be distributed to the pilot or co-pilot unless a phone call is active.

CAUTION

> Failure to turn off telephone audio when the telephone is not in use may result in telephone ringer or text message aural notifications being received during critical phases of flight.

2.26 Multi Crew Aircraft (GMA 35 Only)*

For aircraft type certified with more than one required pilot, or operations requiring more than one pilot, the "Group Co-Pilot with Passenger" audio panel option shall not be activated. This option is found in the Intercom Setup Menu when a Garmin GMA 35 audio panel is installed.

2.27 Wire Obstacle Database

Only the "Obstacle/HOT Line" database may be used. Use of the "Obstacle/Wire" database is prohibited. The database version can be viewed on the start-up database verification or System- System Status pages.

2.28 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

The Flight Stream interface and data provided to a portable electronic device is not approved to replace any aircraft display equipment, including navigation or traffic/weather display equipment.

2.29 Database Updates

Database updates via MMC / SD card or Flight Stream wireless transfers must be done while the aircraft is on the ground and stationary. In-flight database transfers or updates are prohibited in flight unless part of the Database SYNC function that occurs in the background to move databases from one LRU to another.

2.30 Charts Database (Dual GTN7XX)

When the aircraft installation includes 2 GTNs capable of displaying charts (GTN 700, 725 or 750) and crossfill is enabled between the GTNs, the GTNs must have identical charts types (ChartView or FliteCharts) and charts cycles installed. Failure to have identical charts could affect the chart lookup features and automatic chart selection.

2.31 Automatic Speech Recognition

Pilots may not use the ASR function to operate the GTN/GMA unless they have completed the ASR Qualification Procedure located in the GTN Cockpit Reference Guide successfully. The ASR Qualification Procedure is specific to each pilot / headset / aircraft combination.

2.32 OBS Mode

Use of OBS mode for flight plan segments greater than 250NM is prohibited.

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* Includes GMA 35 and GMA 35c Audio Panels

2.33 Advisory Visual Approaches

All advisory visual approaches shall be conducted in VMC. Advisory visual approaches are intended to be used as an aid to situational awareness and do not guarantee terrain or obstruction clearance along the approach path. Use of advisory visual approaches in IMC is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":

Autopilot .... **DISCONNECT**
Aircraft Controls .... **INITIATE MAXIMUM POWER CLIMB**
Airspeed .... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Altitude .... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" and/or "LOI".

If the LOI annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight. If LOI occurs while the GTN is in the ENR or OCN phase of flight, it may also display DR.

If the DR annunciation is displayed, the map will continue to be displayed with an amber "DR" overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation .... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .... **USE GTN**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE (no DR annunciated on the GTN):

Navigation ....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a LPV, LP +V, LNAV/VNAV, or LNAV +V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation to LNAV. The approach may be continued using the LNAV only minimums. If the VISUAL approach is downgraded, the GTN will remove the vertical deviation indication from the VDI, but continue to annunciate VISUAL in amber.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications .... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed)....... **PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)†

Audio Panel Circuit Breaker .... **PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including aural alerting and the crew and passenger intercom will function.

† Includes GMA 35 and GMA 35c Audio Panels

3.2.5 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

NOTE

TAWS annunciators external to the GTN may not indicate the exact threat causing the alert. Example: WIRE alerts may be annunciated as TERR or OBSTACLE on external devices.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Cockpit Reference Guide for additional information.

To Inhibit TAWS:

Home Hardkey .... **PRESS**
Terrain Button.. **PRESS**
Menu Button .... **PRESS**
TAWS Inhibit Button .... **PRESS TO ACTIVATE**

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following limitations apply:

- Roll steering will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- Overlaying traffic data from a TAS/TCAS I or Garmin ADS-B-IN unit interfaced to an on board traffic system will not be displayed on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or Garmin ADS-B-IN traffic data.
- All overlaying StormScope® data on the main map display will be removed. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.
- Onboard weather radar overlay on the main map will not be displayed. The flight crew must utilize the dedicated weather radar page on the GTN system to view weather radar data from the onboard weather radar.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 ASR (VOICE COMMAND) SYSTEM FAILURES

In the event the ASR system fails and there is a need to disable the voice command inputs to the GTN:

To Disable ASR:

Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**

3.2.10 LOSS OF GTN TOUCH CONTROL

In the event the GTN becomes unusable due to uncommanded page changes, the ASR function may be the source.

To Disable ASR:

Audio Panel Circuit Breaker .... **PULL**
Home Hardkey .... **PRESS**
System Button .... **PRESS**
Voice Commands Button .... **PRESS**
Voice Commands Enable Button .... **TOGGLE OFF**
Audio Panel Circuit Breaker .... **PUSH**

3.2.11 DATA SOURCE – PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a barometric corrected altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.12 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 (NAV/GPS 2, COM 2) and the Flight Stream 210 (BT LINK), if installed.

3.2.13 IN-AIR RESTART OF GTN

In the event of a GTN restart in the air, the crew should utilize the CANCEL button if presented with the database update screen after the GTN is restarted. This will ensure restoration of the navigation functions as soon as possible.

Section 4. NORMAL PROCEDURES

Refer to the GTN Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Databases .... **REVIEW DATES**
Self-Test .... **VERIFY OUTPUTS TO NAV INDICATORS**
Self-Test - TAWS Remote Annunciator:
- PULL UP .... **ILLUMINATED**
- TERR .... **ILLUMINATED**
- TERR N/A .... **ILLUMINATED**
- TERR INHB .... **ILLUMINATED**

Self-Test - GPS Remote Annunciator:
- VLOC .... **ILLUMINATED**
- GPS .... **ILLUMINATED**
- LOI or INTG .... **ILLUMINATED**
- TERM .... **ILLUMINATED**
- WPT .... **ILLUMINATED**
- APR .... **ILLUMINATED**
- MSG .... **ILLUMINATED**
- SUSP or OBS .... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators .... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

> The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

See Section 4.5 for RF leg capabilities related to EHSI.

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in a roll steering mode.

The GTN supports autopilot roll steering for heading legs when an approved heading source is interfaced to the GTN. This heading interface can also provide map orientation, traffic and StormScope heading data and wind calculations.

CAUTION

> The GTN does not provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of roll steering when course deviation is not provided.

- ☐ This installation *has* a heading source. The GTN will provide roll steering on heading legs for the autopilot.
- ☑ This installation *does not have* a heading source. The crew cannot use the GTN roll steering to fly heading legs with the autopilot.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

☑ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button .... **PRESS**
"Enable APR Output" Button .... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot.. **ENGAGE APPROACH MODE**

☑ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance.......................................**CONFIRM AVAILABLE**
Autopilot.. **ENGAGE APPROACH MODE**

☐ The installation *does not* support any vertical capture or vertical tracking.

The GTN allows for the utilization of IFR procedures that include RF (Radius to Fix) legs as part of RNP 1.0 capabilities.

☑ This installation is equipped to support coupled RF leg navigation up to RNP 1.0.

☐ This installation is equipped to support *un-coupled* RF leg navigation up to RNP 1.0.

☐ This installation *does not* support RF leg navigation.

4.6 Coupling the Autopilot during Search and Rescue Operations

Search and Rescue (SAR) patterns created in the GTN flight plan may include turns that cannot be accomplished with standard autopilot turn rates. Monitor autopilot performance relative to the desired path if coupled when using Search and Rescue patterns.

4.7 Database Conflict Resolution

When a conflict occurs between databases on different GTNs that are utilizing Database SYNC the pilot should resolve that conflict by pressing the "Resolve Conflict" button on the GTN that has the desired databases. This would be the GTN with the newest database on the SD card or Flight Stream 510. After initiating the conflict resolution, the pilot can view the SYNC status of the database on the other GTN by viewing the System -> Standby Database page. Once the database SYNC is complete, the receiving GTN must be restarted to install the new database and complete the conflict resolution process.

NOTE

The databases on the receiving LRU will be overwritten by the databases from the LRU from which the "Resolve Conflicts" action was initiated.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately available to the flight crew.

- GTN 6XX Pilot's Guide P/N 190-01004-03 Rev L or later
- GTN 7XX Pilot's Guide P/N 190-01007-03 Rev N or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

☐ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.

☑ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

☑ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.

☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

CAUTION

Not all obstacles and wires are contained in the Obstacle/HOT Line database. The system provides depiction (and alerts, if TAWS is installed) only for obstacles and wires contained in the database.

NOTE

The area of coverage may be modified as additional terrain data sources become available.

☑ This installation supports *Terrain Proximity. No aural or visual alerts* for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.

☐ This installation supports *TAWS B*. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

Terrain on the dedicated terrain page or main map overlay is depicted in the following manner:

- Terrain more than 1,000 feet below the aircraft is not depicted, or depicted as black.
- Terrain between 1,000 feet and 100 feet below the aircraft is depicted as amber.
- Terrain within 100 feet below the aircraft, or above the aircraft, is depicted as red.

Obstacles and wires on the dedicated terrain page or main map are depicted in the following manner:

- Obstacles and wires more than 2,000 feet below the aircraft are not depicted.
- Obstacles and wires between 2,000 feet and 1,000 feet below the aircraft are depicted as white.
- Obstacles and wires between 1,000 feet and 100 feet below the aircraft are depicted as amber.
- Obstacles and wires within 100 feet below the aircraft, or above the aircraft, are depicted as red.

Multiple obstacles may be depicted using a single obstacle icon and an asterisk to indicate obstacle grouping is occurring. The color of the asterisk indicates the relative altitude of the tallest obstacle in the group. The asterisk does not indicate any information about the relative altitude or number of obstacles not being displayed in the obstacle group.

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding terrain and obstacle colors and grouped obstacle icons.

7.6 GMA 35/35c Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35/35c remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Optional Bluetooth pairing functionality can be accessed from the associated System /Connext Setup page (GMA 35c only). Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

Aircraft alerting audio may be routed through the GMA 35/35c audio panel. There are no pilot controls for alert audio volumes. In the event of a loss of GMA35/35c function alert audio routed through the audio panel may not be heard.

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

- ☐ No traffic system is interfaced to the GTN.
- ☐ A TAS/TCAS I traffic system is interfaced to the GTN.
- ☐ A TIS traffic system is interfaced to the GTN.
- ☐ A TCAD traffic system is interfaced to the GTN.
- ☑ A Garmin ADS-B traffic system is interfaced to the GTN.
- ☐ A Garmin ADS-B traffic system is interfaced to the GTN. The ADS-B traffic system is also interfaced to an on board traffic system.

7.8 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system.

<u>Heading Up mode:</u>
If the GTN system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label "HDG UP" presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and *is* automatically rotated to the correct relative position as the aircraft turns.

<u>Heading Not Available mode:</u>
If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate "HDG N/A" in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COM (1/2).
- Power to the optional GMA 35 is provided through a circuit breaker labeled AUDIO.
- Power to the optional Flight Stream 210 is provided through a circuit breaker labeled BT LINK.
- Power to the optional Flight Stream 510 is provided through the GTN MMC/SD card slot and protected via the GTN circuit breaker.

7.10 Databases and Flight Plan Waypoints/Procedures

Database versions (or cycles) and effective dates are displayed on the start-up database verification page immediately after power-on for those databases with an effective or expiration date. Databases with no effective or expiration date (e.g. - terrain database) are considered effective upon installation in the GTN. Database information can also be viewed on the System – System Status page.

The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days. The HOT Line wire database only includes the continental United States and portions of Canada/Mexico.

Only the Obstacle/HOT Line wire database may be used in accordance with the limitation found in Section 2.27.

If a stored flight plan contains a waypoint or procedure that does not correspond to a waypoint or procedure in the navigation database in use, the waypoint or procedure will become locked (depicted as "lockd") in the flight plan. Flight plans with locked waypoints may be placed in the active flight plan portion of the system but no navigation will be provided. The locked waypoint/procedure must be resolved by removing or replacing it with the correct waypoint/procedures in the flight plan before the system will provide navigation.

7.11 External Switches

External switches may be installed and interfaced to the GTN. These switches may be stand alone, or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the COM active / standby frequencies.
NAV RMT XFR	Transfers the NAV active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is Inhibited.
PTC	Push-to-Command switch for Voice Command input to the GMA and the GTN.

Table 4 – External Switches

7.12 Airspace Depiction and Alerts

The GTN aides the flight crew in avoiding certain airspaces with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.13 Garmin ADS-B Traffic System Interface (Optional)

A Garmin ADS-B traffic system may be interfaced to the GTN. The *nose* of the ownship symbol on both the GTN main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the "Next" button on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

7.14 GWX 70 Weather Radar (Optional)
The GWX 70 Weather Radar uses Doppler technology to optionally provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. Turbulence detection can detect turbulence up to 40nm from the aircraft and will be displayed at radar ranges of 160nm or less.

NOTE

Turbulence detection does not detect all turbulence especially that which is occurring in clear air. The display of turbulence indicates the possibility of severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.15 Charts (Optional)
The GTN 750/725 can display both procedure charts and weather data on the main map page at the same time. When datalink NEXRAD or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

7.16 Transponder Control (Optional)
The GTN can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the "Enable ES" button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

7.17 Telephone Audio (Optional)
Telephone audio distribution to the crew defaults to OFF on each power cycle of the GTN. Prior to utilizing the telephone function, the crew must distribute telephone audio to the desired recipients. If the crew is utilizing the telephone function it is required that the telephone audio be turned off upon completing telephone usage.

7.18 Depiction of Obstacles and Wires

7.18.1 Dedicated Terrain Page

The dedicated Terrain page will always depict point obstacles at zoom scales of 10 nm or less and depict wire obstacles at zoom scales of 5 nm or less. The obstacle or wire overlay icon (see Figure 3) will be shown near the bottom of the display when the obstacle or wire depiction is active based on the zoom scale.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Terrain page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

Figure 3 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.18.2 Map Page

The Map page may be configured to depict point obstacles and wire obstacles at various zoom scales by the pilot by using the Map page menu. The obstacle or wire overlay icon (see Figure 4) will be shown near the bottom of the display when the obstacle or wire overlay is active based on the current zoom scale and setting selected by the pilot.

The settings chosen by the pilot on the Map page menu (including obstacle and wire display ranges) are saved over a power cycle.

NOTE

Only obstacles and wires within 2,000 feet vertically of the aircraft will be drawn on the Map page. It is therefore possible to have an obstacle or wire overlay icon displayed with no obstacles or wires being depicted on the display.

NOTE

The Map page may be configured by the pilot to not show any obstacles or wires at any zoom scale.

Figure 4 – Obstacle Overlay Icon (Left), Wire Overlay Icon (Right)

7.19 Flight Stream 210/510 (Optional)

The Flight Stream product line uses a wireless transceiver to provide data to and from a GTN to personal electronic devices (PEDs).

The Flight Stream 210 is a remotely mounted unit that provides the capability to interface Portable Electronic Devices (PEDs) to the GTN via Bluetooth. The Flight Stream 510 is mounted in the GTN SD card slot and includes a Bluetooth and Wi-Fi transceiver.

Data such as traffic, flight plan, datalink weather, entertainment audio information, and attitude information is sent from the Flight Stream to the PED. The PED is capable of sending flight plans and databases (510 only) to the Flight Stream which will then be available on the GTN. Limitations regarding database operations are found in Section 2.29.

Garmin provides a list of tested and compatible devices that can be used with the Flight Stream. Connection to the Flight Stream may be possible with devices other than those on the supported device list, but Bluetooth® and/or Wi-Fi stability and wireless data integrity cannot be guaranteed.

For details about the Garmin supported devices and apps for use with the Flight Stream product line, please visit: http://garmin.com/connext/supported_devices

7.20 Map Page

7.20.1 Configuration

The moving map and weather pages are capable of displaying a large quantity and variety of data. Map data is layered to ensure that data which is typically more critical is drawn above less critical data, however at some zoom scales and configurations the map may be cluttered with large amounts of data. Controls are provided on the Map and Weather pages for the pilot to select which data displayed, the declutter level, and the zoom scales at which data is added to or removed from the display. It is the responsibility of the pilot to select settings for the map page that will provide the display of data most appropriate to the operation being conducted.

7.20.2 Flight Plan Depiction

The map page depicts the current active flight plan. When an off-route Direct To is active the flight plan will no longer be depicted on the map.

7.20.3 Fuel Range Ring

The distance between the segmented green reserve ring and the yellow zero fuel ring is 45 minutes at the current aircraft groundspeed by default. The pilot may change the fuel reserve time value on the map setup menu. Changes to the fuel reserve time are persisted over GTN power cycles.

Visibility of the fuel range ring may be affected by the underlying map data selectable by the pilot. The pilot may make changes to the topographic or terrain data in order or more clearly observe the fuel range ring at any time.

Fuel range data is derived from the interfaced fuel totalizer data. Data entered in the Fuel Planning pages will not update the fuel range ring.

7.21 User Defined Waypoints

When a User Defined Waypoint is created a default name will automatically be provided and the pilot is given the option to provide a different name for the waypoint. Pages which have the autofill function will prevent some waypoint names from being used. If it is desired to name the waypoint with a subset of the name of an existing waypoint in the database then this must be accomplished on the Waypoint Info / User Waypoints page.

Waypoints which are created when a Search and Rescue pattern is created are not considered User Waypoints and therefore functions associated with User Waypoints are not provided for these waypoints.

7.22 Times and Distances

Time and Distance data to the next waypoint is always calculated from the present position to that waypoint and does not account for the path which may be flown (such as intercepting a course) to reach the waypoint.

When navigating using GPS guidance most legs are TO type legs where distance to the next waypoint decreases along the route. However, some procedures include FROM type legs. When navigating on a leg that is a FROM leg indications that it is a FROM leg include the TO/FROM flag indicating FROM and distances increasing in distance fields.

7.23 GTN-GTN Crossfill

Certain data will sync between GTNs when installed in a dual GTN configuration. The following data will crossfill between the two GTNs with CROSSFILL ON or OFF:

- User Waypoints
- FPL Catalog
- Traffic Alerts
- Missed Approach Popups
- Altitude Leg Popups
- Heading
- Date/Time Conventions
- CDI Scale

The following unit changes will crossfill:

- Temperature
- NAV Angle
- Fuel

The following items are crossfilled only when the GTNs are set to CROSSFILL ON:

- User Holds
- Approaches
- Flight Plan Changes
- Direct-To
- Selected OBS Course Changes

7.24 Direct-To Operations

When conducting Direct-To operations the Flight Plan tab provides a list of waypoints in the flight plan for which Direct-To is available. Some entries in the flight plan such as Holds and Course Reversals are not eligible for Direct-To and the pilot must instead select the associated waypoint if Direct-To operation is desired.

7.25 Automatic Speech Recognition (ASR)

ASR allows the pilot to interact with the GMA and GTN via voice commands. Commands are constructed around the "Verb – Noun – (Suffix)" syntax for most ASR commands.

- **"SHOW"** Commands – Used to show pages or data fields on the GTN
- **"SAY"** Commands – Used to instruct the ASR engine to say certain phrases related to the flight
- **"TUNE"** Commands – Used to tune certain frequencies into the standby position of the ASR GTN (usually GTN #1)

The "Page" suffix is used in conjunction with the "Show" phrase to command pages to be displayed on the GTN. (e.g.- "Show Main Map Page")

Audio Panel commands are available to switch audio sources.

- **"SELECT"** to choose which radio the MIC will be selected
- **"TOGGLE"** to toggle the monitor of a specific NAV/COM radio
- **"DISTRIBUTE"** to change the source of audio for the respective seat positions
- **"MUTE"** to mute audio inputs on the audio panel for the respective seat positions

Supplemental commands that allow map zooming, and page navigation are also available.

- **"BACK"**
- **"CANCEL"**
- **"ZOOM IN"**
- **"ZOOM OUT"**

Each command is initiated via the Push-to-Command (PTC) switch. Aural tones will indicate to the pilot the status of the command. A positive tone (low to high) will indicate the system executed a command. A negative tone (high to low) will indicate the system did not understand the command or could not execute due to system state or configuration. "SAY" commands do not provide aural tones as feedback.

The pilot must maintain vigilance regarding ASR command information. Due to the nature of voice recognition, there are times when ASR will interpret a command differently than the pilot intended. The pilot should always cross check the ASR response to the information contained within the GTN as appropriate to ensure in-flight information is accurately understood. If a conflict exists between information gathered via ASR and that available in the GTN system, the pilot should defer to the GTN system information.

Prior to using ASR, the pilot must complete the ASR Qualification Procedure from the GTN Cockpit Reference Guide.

The Command History Page details the commands received by ASR for that power cycle. A full list of commands and a tips for using ASR can be found in the *GTN 6XX/7XX Telligence Voice Command Guide,* 190-01007-50.

When using ASR for "TUNE" commands, it is recommended that the pilot enable Reverse Frequency Lookup (RFL) on the associated GTN.

7.26 European Visual Reporting Points

If the GTN is interfaced with a G500/600 PFD/MFD, and a flight plan in the GTN contains a VRP, the G500/600 must have a database that contains the VRP in order to appropriately display the VRP on the MFD map. If the database on the PFD/MFD does not contain the VRP, the VRP will display on the MFD map as an intersection.

7.27 Advisory Visual Approaches

The GTN will provide advisory visual approaches to many runways in the aviation database. Lateral guidance for the visual approach is aligned with the runway bearing. Vertical guidance is provided for those runways with VGSI information for distances up to 4.0NM from the runway. If a terrain database is installed in the GTN, the GTN provides vertical guidance up to 28NM from the runway end unless the computed glideslope would impact terrain or obstacles from the database. If the projected impact point is under 28NM and greater than 4NM, the flight plan line for the approach is shortened to indicate where vertical guidance is active for the approach. If the terrain impact point is less than 4NM from the runway and there is no VGSI data available, vertical guidance is not provided for that approach. Lateral guidance is still available when vertical guidance is removed.

CDI and VDI indications are equivalent to those of other GPS-based approaches (e.g.- LPV or LNAV+V). The GTN annunciates "VISUAL" in the annunciator bar to indicate a visual approach is active.

When loading, or activating the approach, the GPA and TCH information for that approach will be displayed on a popup. If there is no vertical guidance available, the popup will display "(NO VERTICAL GUIDANCE)".

Visual approaches are intended to be used as an aid to situational awareness. Visual approaches are advisory in nature and do not guarantee terrain and obstacle clearance for the approach runway.

Garmin International, Inc.
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Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GTX 33X and GTX 3X5 Transponders with ADS-B
as installed in

Piper PA-23-250
Make and Model Airplane

Registration Number: N362BP Serial Number: 27-7954048

This document serves as an FAA Approved Airplane Flight Manual Supplement or Supplemental Airplane Flight Manual when the GTX 33X or GTX 3X5 with ADS-B is installed in accordance with Supplemental Type Certificate SA01714WI. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the FAA approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA approved Airplane Flight Manual, markings, or placards.

FAA Approved By: Michael Warren

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 08-MAR-2016

LOG OF REVISIONS				
	Page			
Revision Number	Date	Number	Description	FAA Approved
1	05/01/2013	All	Complete Supplement	Robert Murray Robert Murray ODA STC Unit Administrator Garmin International, Inc. ODA-240087-CE Date: 05/01/2013
2	03/08/2016	All	New supplement format with GTX 3X5 added.	See cover page

Table of Contents

Section 1. GENERAL

1.1 GTX 33X

The Garmin GTX 33X family consists of the GTX 330 ES and GTX 33 ES (Non-Diversity Mode S Transponders) and the GTX 330D ES and GTX 33D ES (Diversity Mode S Transponders). The ES option of any of the transponders provides ADS-B extended squitter functionality.

All Garmin GTX 33X transponders are a radio transmitter/receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. Each unit is equipped with IDENT capability and will reply to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Interfaces to the GTX 33X are shown in the following block diagrams.

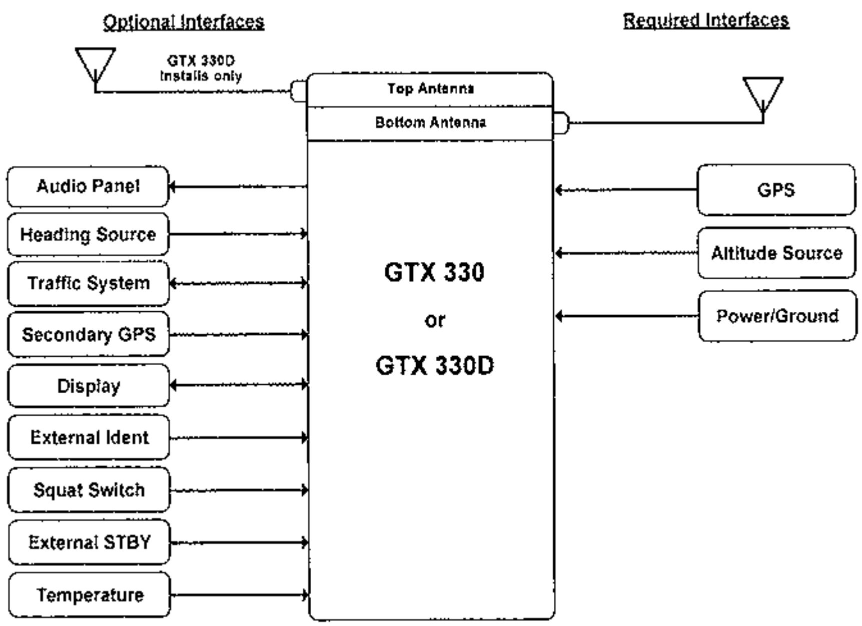

Figure 1 – GTX 330 or GTX 33D Interface Summary

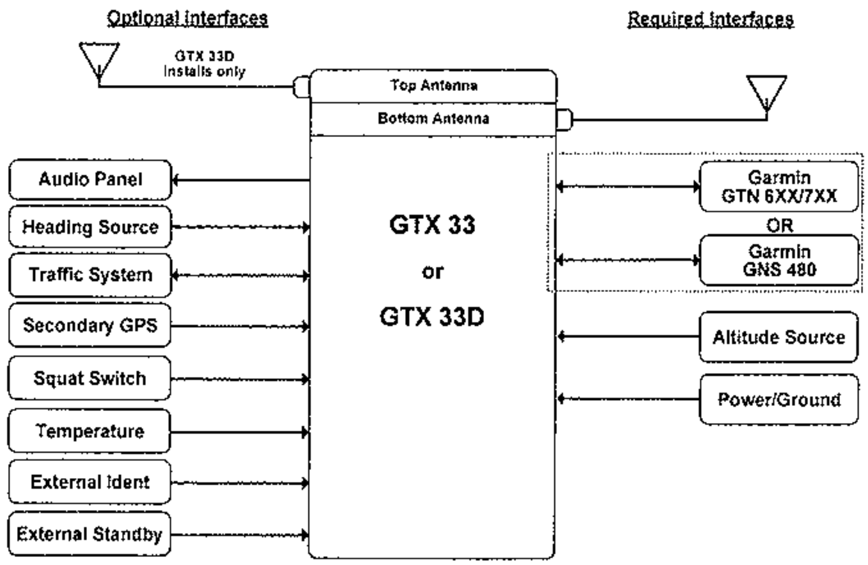

Figure 2 – GTX 33 or GTX 33D Interface Summary

The GTX 33X performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090ES) (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Code, IDENT, and Emergency Status
    - Pressure Altitude Broadcast Inhibit
- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output

1.2 GTX 3X5

The Garmin GTX 3X5 family consists of the GTX 335, 335R, 345, and 345R transponders. The functional differences between each of these transponders are described in Table 1.

Function	GTX 335	GTX 335 w GPS	GTX 335R	GTX 335R w GPS	GTX 345	GTX 345 w GPS	GTX 345R	GTX 345R w GPS
Panel mount	x	x			x	x		
Remote mount			x	x			x	x
Mode S	x	x	x	x	x	x	x	x
ADS-B (out)	x	x	x	x	x	x	x	x
ADS-B Traffic					x	x	x	x
FIS-B					x	x	x	x
Internal GPS		x		x		x		x
Bluetooth					x	x	x	x
Optional Garmin Altitude Encoder	x	x	x	x	x	x	x	x

Table 1 – GTX 3X5 Unit Configurations

Interfaces to the GTX 3X5 are shown in Figure 3.

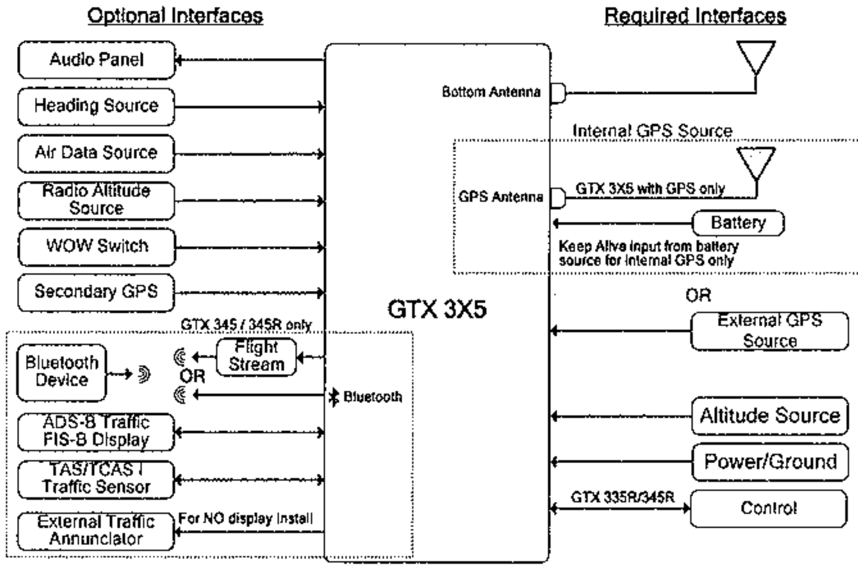

Figure 3 – GTX 3X5 Interface Summary

The GTX 3X5 performs the following functions:

- Transmission of ADS-B out data on 1090 extended squitter (1090ES) (1090 MHz)
    - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227:
        - GPS Position, Altitude, and Position Integrity
        - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
        - Air Ground Status
        - Flight ID, Call Sign, ICAO Registration Number
        - Capability and Status Information
        - Transponder Squawk Code, IDENT, and Emergency Status
    - Pressure Altitude Broadcast Inhibit

The GTX 335 performs the following additional functions:

- Reception of TIS-A traffic data from a ground station
- Provide TIS-A traffic alerting to the pilot via interfaced display and audio output.

The GTX 345 performs the following additional functions:

- Reception of ADS-B In data on 1090 MHz
    - ADS-B (Data directly from another transmitting aircraft)
    - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Reception of ADS-B In data on UAT (978 MHz)
    - ADS-B (Data directly from another transmitting aircraft)
    - ADS-R (Rebroadcast of ADS-B data from a ground station)
    - TIS-B (Broadcast of secondary surveillance radar) (SSR) derived traffic information from a ground station.
    - FIS-B (Broadcast of aviation data from a ground station)
- Provide ADS-B traffic information and alerting to the pilot via an interfaced display
    - Correlation and consolidation of traffic data from multiple traffic sources
    - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an interfaced display
    - Graphical and textual weather products
        - NEXRAD
        - PIREPs
        - AIRMET/SIGMETs
        - METARs
        - TAFs
        - Winds Aloft
    - Aviation Data
        - TFRs
        - NOTAMs

1.3 Capabilities

The Garmin GTX 33X and GTX 3X5 as installed in this aircraft have been shown to meet the equipment requirements of 14 CFR § 91.227 when operating in accordance with sections 2.1 and 2.2 of this supplement.

1.4 Installation Configuration

This aircraft is equipped with a GTX 33X and/or GTX 3X5 with the following interfaces/ features:

Equipment Installed:

Transponder #1	Transponder #2 (if installed)
☐ GTX 330	☐ GTX 330
☐ GTX 330D	☐ GTX 330D
☐ GTX 33	☐ GTX 33
☐ GTX 33D	☐ GTX 33D
☐ GTX 335	☐ GTX 335
☐ GTX 335R	☐ GTX 335R
☑ GTX 345	☐ GTX 345
☐ GTX 345R	☐ GTX 345R

Interfaced GPS/SBAS Position Source(s):

GPS #1	GPS #2 (if installed)
☐ Internal	☐ Internal
☑ GTN 6XX/7XX Series	☐ GTN 6XX/7XX Series
☐ GNS 400W/500W Series	☐ GNS 400W/500W Series
☐ GNS 480	☐ GNS 480
☐ GIA 63	☐ GIA 63
☐ GDL 88 (GTX 330 only)	☐ GDL 88 (GTX 330 only)

Interfaced Pressure Altitude Source:

Pressure Altitude Source #1	Pressure Altitude Source #2 (if installed)
☐ ____________________	☐ ____________________
☑ Garmin Altitude Encoder	☐ Garmin Altitude Encoder

Interfaced Remote Control Display (Required for remotely mounted GTX variants):

Transponder #1 Remote Control Display	Transponder #2 Remote Control Display (if installed)
☑ GTN 6XX/7XX	☐ GTN 6XX/7XX
☐ GNS 480	☐ GNS 480
☐ G950/1000 Display	☐ G950/1000 Display

Interfaced Active Traffic System:

☑ None

☐ TCAD

☐ TAS/TCAS

NOTE

If the system includes all of the following components:

- GTX 345R,
- G950/1000 Display, and
- TCAD or TAS/TCAS

Then the aircraft is no longer equipped with a TSO compliant active TCAD, TAS or TCAS system. Any operational requirement to be equipped with such system is no longer met.

1.5 Definitions

The following terminology is used within this document:

ADS-B:	Automatic Dependent Surveillance-Broadcast
AFM:	Airplane Flight Manual
AFMS:	Airplane Flight Manual Supplement
ATCRBS:	Air Traffic Control Radar Beacon System
CFR:	Code of Federal Regulations
ES:	Extended Squitter
GNSS:	Global Navigation Satellite System
GNS:	Garmin Navigation System
GPS:	Global Positioning System
GTX:	Garmin Transponder
GTN:	Garmin Touchscreen Navigator
ICAO:	International Civil Aviation Organization
LRU:	Line Replaceable Unit
PABI:	Pressure Altitude Broadcast Inhibit
POH:	Pilot Operating Handbook
SBAS:	Satellite-Based Augmentation System
SW:	Software
TCAS:	Traffic Collision Avoidance System
TIS:	Traffic Information Service
TX:	Transmit

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GTX 33X and GTX 3X5 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

Interfaced Equipment	Number Installed	Number Required
Uncorrected Pressure Altitude Source	1	1
GPS SBAS Position Source	1 or more	1
Remote Control Display (for remotely mounted transponders)	1 or more	1

Table 2 – Required Equipment

2.2 ADS-B Out

The GTX 33X and GTX 3X5 only comply with 14 CFR 91.227 for ADS-B Out when all required functions are operational. When the system is not operational, ADS-B Out transmit failure messages will be present on the remote control display interface, or the GTX 330 or GTX 3X5 panel display.

2.3 TIS Traffic Display with User Navigation Angle

Display of TIS traffic from a GTX 33/330 or GTX 335 is not permitted with an interfacing display configured for a navigation angle of "user".

2.4 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main GTX software version is displayed on the splash screen during start up for the GTX 330 and GTX 3X5 panel mounted units, and the External LRU or System page on the interfaced remote control display for remotely mounted GTX transponders.

Software Item	Software Version *(or later FAA Approved versions for this STC)*
GTX 33X Main SW Version	8.02
GTX 3X5 Main SW Version	2.02

Table 3 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control while operating within airspace requiring an ADS-B Out compliant transmitter per 14 CFR 91.227. PABI is enabled by selecting the GTX to ON mode.

2.6 Datalinked Weather Display (GTX 345 Only)

Do not use datalink weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by datalink weather products may not accurately depict current weather conditions.

Do not use the indicated datalink weather product age to determine the age of the weather information shown by the datalink weather product. Due to time delays inherent in gathering and processing weather data for datalink transmission, the weather information shown by the datalink weather product may be significantly older than the indicated weather product age.

Do not rely solely upon datalink services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information.

2.7 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.23 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No Change.

3.2 Abnormal Procedures

3.2.1 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

XPDR Circuit Breaker .... PULL

Transponder and ADS-B Out functions will no longer be available.

NOTE

> This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

3.2.2 LOSS OF GPS/SBAS POSITION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GTX will no longer be transmitting ADS-B Out data.

For GTX 330 installations:

NO ADSB annunciator illuminated:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

For GTX 3X5 installations:

NO 1090ES TX annunciator illuminated:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

For GTX 33 and GTX 3X5R installations:

Reference Display Device documentation for applicable annunciation:

Interfaced GPS position sources .... **VERIFY VALID POSITION**

3.2.3 Dual GTX 3X5R Transponders in a G950/1000 installation

If Transponder #1 fails and Transponder #2 is activated by the pilot, the G1000 display will provide nuisance alerts unless power is removed from Transponder #1.

Transponder #1 Failed, Transponder #2 Active

Transponder #1 Circuit Breaker .... **PULL**

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the panel mounted GTX 330 or GTX 3X5 transponders. Cockpit Reference Guides and Pilot Guides for interfaced remote control displays will provide additional operating information specific to the displays or other traffic systems.

ADS-B Out functionality resides within the GTX transponders thereby providing a single point of entry for Mode 3/A code, Flight ID, IDENT functionality and activating or deactivating emergency status for both transponder and ADS-B Out functions. Details on performing these procedures are located in the GTX 330/330D Pilot's Guide and GTX 3X5 Series Transponder Pilot's Guide.

4.1 Unit Power On

For GTX 330 installations:

GTX Mode .... **VERIFY ALT**
NO ADSB .... **CONSIDERED**

For GTX 3X5 installations:

GTX Mode .... **VERIFY ALT**
NO 1090ES TX .... **CONSIDERED**

NOTE

The NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

4.2 Before Takeoff

For GTX 330 installations:

ADS-B TX .... **VERIFY ON**
NO ADSB .... **EXTINGUISHED**

For GTX 3X5 installations:

1090ES TX CTL .... **VERIFY ON**
NO 1090ES TX .... **EXTINGUISHED**

NOTE

The ADS-B TX or 1090ES TX CTL must be turned on and the NO ADS-B or NO 1090ES TX Annunciation (or associated display annunciations) must be **EXTINGUISHED** for the system to meet the requirements specified in 14 CFR 91.227. This system must be operational in certain airspaces after January 1, 2020 as specified by 14 CFR 91.225.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTION

The Garmin GTX 330 and GTX 3X5 Pilot's Guides, part numbers, and revisions listed below contain additional information regarding GTX system description, control, and function.

Title	Part Number	Revision
GTX 330 Pilot's Guide GTX 3X5 Pilot's Guide	190-00207-00 190-01499-00	Rev. G (or later) Rev. A (or later)

Pilot's Guides for interfaced displays, part numbers and revisions listed below, provide additional operating information for the Garmin GTX 33 and GTX 3X5R.

Title	Part Number	Revision
Garmin GTN 725/750 Pilot's Guide	190-01007-03	Rev. E (or later)
Garmin GTN 625/635/650 Pilot's Guide	190-01004-03	Rev. E (or later)
GNS 480 Pilot's Guide	190-00502-00	Rev. D (or later)
GTX 3X5 Series Transponder G1000 Pilot's Guide	190-01499-01	Rev. A (or later)

7.1 GTX TIS Behavior

The TIS Standby/Operate controls for GTX 33/330 and GTX 335 units only function when the aircraft is airborne.

7.2 GTX 345R and G950/1000 No Bearing Traffic Alerts

No visual indication is provided for no bearing traffic alerts. Only an aural indication of the no bearing traffic alert is provided. If an aural alert for no bearing traffic has been previously issued, a "no bearing traffic clear" aural indication will be provided once all traffic alerts are resolved.

All aural alerts are inhibited below 500' AGL, therefore a "no bearing traffic clear" aural may not be heard in a landing or touch and go flight scenario.

TABLE OF CONTENTS

SECTION 10

SAFETY TIPS

SECTION 10

SAFETY TIPS

10.1 GENERAL

This section provides safety tips of particular value in the operation of the Aztec F.

10.3 SAFETY TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the wheel is required to rotate the airplane from the ground.

(b) Due to the very rapid feathering action of the propeller on the Aztec F, it will be necessary when feathering during ground check to move the propeller control in and out of feather position very quickly in order to prevent the RPM from dropping more than 500 RPM and causing excessive manifold pressure.

(c) On takeoff, do not retract the gear permaturely. The airplane may settle and make contact with the ground because of lack of flying speed, atmospheric conditions or rolling terrain.

(d) The best speed for takeoff is 64 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in event of engine failure. (Minimum controllable single engine airspeed is 64 KIAS.)

(e) Do not use fuel crossfeed to compensate for an inoperative emergency fuel pump.

(f) In high density areas where high traffic pattern speeds are necessary or when it is advantageous to extend the gear, it is permissible to extend the landing gear at speeds up to 132 KIAS; however, it is recommended the landing gear should normally be extended at speeds below 132 KIAS.

(g) Flaps may be lowered at speeds shown in this handbook. Slower speeds are desirable to help reduce flap operating loads.

(h) When an open circuit breaker is discovered, reset the breaker. If the breaker pops again, allow a two to five minute cooling off period before attempting to reset again.

(i) Always determine position of landing gear by checking the gear position lights and the mirror on the right side of the left cowl.

(j) To prevent tripping the overheat lockout switch and to get best service life from the heater components, it is recommended that the heater switch be turned to "FAN" just prior to landing. This will allow adequate cooling during ground operation.

(k) Before starting the engines, check that all radio switches, light switches, the autopilot switch, the prop. synch. switch, and the pitot heat switch are in an off position so as not to create an overloaded condition when the starter is engaged.

(l) The trim tab on the Aztec F is very responsive and a small adjustment in trim control gives a rapid trim change attitude.

(m) When flying in icing conditions the engine ram air filter can flash over with impact ice. The alternate air door will open and a manifold pressure change may occur.

(n) A high fuel pressure indication on the fuel flow indicator is a possible indication of restricted air bleed nozzles.

(o) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available at approximately twenty-three Air Force Bases throughout the United States for a small fee. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P. O. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

(p) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(q) The shape of the wing fuel tanks is such that in certain maneuvers the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by having adequate fuel in the tank selected and avoiding maneuvers which could result in uncovering the outlet.

Normal and running turning takeoffs are not to be made when tank selected is less than one-quarter full as fuel flow interruption may occur.

Prolonged slips or skids of 30 seconds or more, in any pitch attitude,or other unusual or abrupt maneuvers which could cause uncovering of the fuel outlet must be avoided when the tank selected is less than one-quarter full.

(r) If a single-engine landing is necessary, a check should be performed to determine whether or not the hydraulic pump is functioning for normal gear extension. This check is accomplished by placing the landing gear control in the "UP" position with the gear retracted. If the hydraulic pump is functioning, pressure will return the control to the neutral position. This check should be performed before entering the traffic pattern so that there will be time to pump the gear down with the hand pump or, if installed, to employ the emergency CO_2 gear extension system.

(s) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed. Therefore, it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. Fast reduction of power may be harmful to the engine.